

Analysis of RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019

Friganović, Emilija; Nimak, Antea; Sečan, Ančica; Dorbić, Boris; Matin, Ana; Ćurić, Duška; Krička, Tajana

Source / Izvornik: **GLASILO FUTURE, 2022, 5, 15 - 36**

Journal article, Published version

Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

<https://doi.org/10.32779/gf.5.1-2.2>

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:204:603034>

Rights / Prava: [Attribution-NonCommercial-NoDerivatives 4.0 International](#)/[Imenovanje-Nekomercijalno-Bez prerada 4.0 međunarodna](#)

Download date / Datum preuzimanja: **2024-05-17**



Repository / Repozitorij:

[Repository Faculty of Agriculture University of Zagreb](#)



ISSN 2623-6575

UDK 63

GLASILO FUTURE

PUBLIKACIJA FUTURE - STRUČNO-ZNANSTVENA UDRUGA ZA PROMICANJE ODRŽIVOG RAZVOJA, KULTURE I MEĐUNARODNE SURADNJE, ŠIBENIK

VOLUMEN 5 BROJ 1-2

LIPANJ 2022.

Glasilo Future

Stručno-znanstveni časopis

Nakladnik:

FUTURA



Sjedište udruge: Šibenik

Adresa uredništva:

Bana Josipa Jelačića 13 a, 22000 Šibenik, Hrvatska / Croatia

☎ / 📠: +385 (0) 022 218 133

✉: urednistvo@gazette-future.eu / editors@gazette-future.eu

🌐: www.gazette-future.eu

Uređivački odbor / Editorial Board:

Doc. dr. sc. Boris Dorbić, prof. v. š. – glavni i odgovorni urednik / *Editor-in-Chief*Emilija Friganović, dipl. ing. preh. teh., v. pred. – zamjenica g. i o. urednika / *Deputy Editor-in-Chief*Ančica Sečan, mag. act. soc. – tehnička urednica / *Technical Editor*Antonia Dorbić, mag. art. – zamjenica tehničke urednice / *Deputy Technical Editor*

Prof. dr. sc. Željko Španjol

Mr. sc. Milivoj Blažević

Vesna Štibrić, dipl. ing. preh. teh.

Međunarodno uredništvo / International Editorial Board:

Dr. sc. Gean Pablo S. Aguiar – Savezna republika Brazil (Universidade Federal de Santa Catarina)

Prof. dr. sc. Kiril Bahcevandziev – Portugalska Republika (Instituto Politécnico de Coimbra)

Prof. dr. sc. Martin Bobinac – Republika Srbija (Šumarski fakultet Beograd)

Prof. dr. sc. Zvezda Bogevska – Republika Sjeverna Makedonija (Fakultet za zemjodelski nauki i hrana Skopje)

Dr. sc. Bogdan Cvjetković, prof. emeritus – Republika Hrvatska (Agronomski fakultet Zagreb)

Prof. dr. sc. Duška Čurić – Republika Hrvatska (Prehrambeno-biotehnoški fakultet Zagreb)

Prof. dr. sc. Margarita Davitkovska – Republika Sjeverna Makedonija (Fakultet za zemjodelski nauki i hrana Skopje)

Prof. dr. sc. Dubravka Dujmović Purgar – Republika Hrvatska (Agronomski fakultet Zagreb)

Prof. dr. sc. Josipa Giljanović – Republika Hrvatska (Kemijsko-tehnološki fakultet u Splitu)

Prof. dr. sc. Semina Hadžiabulić – Bosna i Hercegovina (Agromediteranski fakultet Mostar)

Prof. dr. sc. Péter Honfi – Mađarska (Faculty of Horticultural Science Budapest)

Prof. dr. sc. Mladen Ivić – Bosna i Hercegovina (Univerzitet PIM)

Doc. dr. sc. Anna Jakubczak – Republika Poljska (Uniwersytet Technologiczno-Przyrodniczy w Bydgoszczy)

Dr. sc. Željko Jurjević – Sjedinjene Američke Države (EMSL Analytical, Inc., North Cinnaminson, New Jersey)

Prof. dr. sc. Mariia Kalista – Ukrajina (National Museum of Natural History of National Academy of Sciences of Ukraine, Kyiv)

Prof. dr. sc. Tajana Krička – Republika Hrvatska (Agronomski fakultet Zagreb)

Doc. dr. sc. Dejan Kojić – Bosna i Hercegovina (Univerzitet PIM)

Slobodan Kulić, mag. iur. – Republika Srbija (Srpska ornitološka federacija i Confederation ornitologique mondiale)

Prof. dr. sc. Branka Ljevnaić-Mašić – Republika Srbija (Poljoprivredni fakultet Univerziteta u Novom Sadu)

Doc. dr. sc. Zvonimir Marijanović – Republika Hrvatska (Kemijsko-tehnološki fakultet u Splitu)

Semir Maslo, prof. – Kraljevina Švedska (Primary School, Lundåkerskolan, Gislaved)

Prof. dr. sc. Ana Matin – Republika Hrvatska (Agronomski fakultet Zagreb)

Prof. dr. sc. Elizabeta Miskoska-Milevska – Republika Sjeverna Makedonija (Fakultet za zemjodelski nauki i hrana)

Prof. dr. sc. Bosiljka Mustać – Republika Hrvatska (Sveučilište u Zadru)

Prof. dr. sc. Ayşe Nilgün Atay – Republika Turska (Mehmet Akif Ersoy University – Burdur, Food Agriculture and Livestock School)

Prof. dr. sc. Tatjana Prebeg – Republika Hrvatska (Agronomski fakultet Zagreb)

Prof. dr. sc. Bojan Simovski – Republika Sjeverna Makedonija (Fakultet za šumarski nauki, pejzažna arhitektura i ekoinženjering "Hans Em" Skopje)

Prof. dr. sc. Davor Skejić – Republika Hrvatska (Građevinski fakultet Zagreb)

Akademik prof. dr. sc. Mirko Smoljić, prof. v. š. – Republika Hrvatska (Sveučilište Sjever, Varaždin/Koprivnica, Odjel ekonomije)

Prof. dr. sc. Nina Šajna – Republika Slovenija (Fakulteta za naravoslovje in matematiko)

Doc. dr. sc. Mladenka Šarolić – Republika Hrvatska (Kemijsko-tehnološki fakultet u Splitu)

Akademik prof. dr. sc. Refik Šećibović – Bosna i Hercegovina (Visoka škola za turizam i menadžment Konjic)

Prof. dr. sc. Andrej Šušek – Republika Slovenija (Fakulteta za kmetijstvo in biosistemske vede Maribor)

Prof. dr. sc. Elma Temim – Bosna i Hercegovina (Agromediteranski fakultet Mostar)

Doc. dr. sc. Merima Toromanović – Bosna i Hercegovina (Biotehnički fakultet Univerziteta u Bihaću)

Prof. dr. sc. Marko Turk – Ruska Federacija (University of Tyumen)

Prof. dr. sc. Ivana Vitasović Kosić – Republika Hrvatska (Agronomski fakultet Zagreb)

Prof. dr. sc. Ana Vujošević – Republika Srbija (Poljoprivredni fakultet Beograd)

Sandra Vuković, mag. ing. – Republika Srbija (Poljoprivredni fakultet Beograd)

Prof. dr. sc. Vesna Židovec – Republika Hrvatska (Agronomski fakultet Zagreb)

Grafika priprema: Ančica Sečan, mag. act. soc.

Objavljeno: 30. lipnja 2022. godine.

Časopis izlazi u elektroničkom izdanju dva puta godišnje, krajem lipnja i prosinca, a predviđena su i dva specijalna izdanja tijekom godine iz biotehničkog područja.

Časopis je besplatan. Rukopisi i recenzije se ne vraćaju i ne honoriraju.

Autori/ce su u potpunosti odgovorni/e za sadržaj, kontakt podatke i točnost engleskog jezika.

Umnožavanje (reproduciranje), stavljanje u promet (distribuiranje), priopćavanje javnosti, stavljanje na raspolaganje javnosti odnosno prerada u bilo kojem obliku nije dopuštena bez pismenog dopuštenja Nakladnika.

Sadržaj objavljen u Glasilo Future može se slobodno koristiti u osobne i obrazovne svrhe uz obvezno navođenje izvora.

Časopis je indeksiran u CAB Abstract (CAB International).

Glasilo Future

Stručno-znanstveni časopis

FUTURA – stručno-znanstvena udruga za promicanje održivog razvoja, kulture i međunarodne suradnje, Bana Josipa Jelačića 13 a, 22000 Šibenik, Hrvatska

(2022) 5 (1-2) 01–76

SADRŽAJ:

	Str.
<i>Izvorni znanstveni rad (original scientific paper)</i>	
<i>Aiša Širbegović, Aida Šukalić, Maida Đapo-Lavić, Alma Mičijević, Alma Leto</i> Frequency of consumption of coffee beverages in the city of Mostar and caffeine intake ...	01–14
<i>Emilija Friganović, Antea Nimak, Ančica Sečan, B. Dorbić, Ana Matin, Duška Ćurić, Tajana Krička</i> Analysis of RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019	15–36
<i>Emilija Friganović, Anita Krezo, Ančica Sečan, B. Dorbić, Ana Matin, Tajana Krička, Duška Ćurić</i> Analysis of RASFF notifications on allergens in cereals and cereal-based products in the period from 01/01/2015 to 31/12/2019	37–63
<i>Stručni rad (professional paper)</i>	
<i>Sandra Mandinić, Katja Kopilaš, B. Dorbić, Marija Vrdoljak</i> Proizvodnja, svojstva i upotreba magarećeg mlijeka (u prehrambene i kozmetičke svrhe) Production, properties and use of donkey milk (for food and cosmetic purposes)	64–73
<i>Nekategorizirani rad (uncategorised paper)</i>	
<i>B. Dorbić</i> Društvene vijesti i obavijesti Social news and announcements	74–74
<i>Upute autorima (instructions to authors)</i>	75–76

Analysis of RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019

**Emilija Friganović^{1*}, Antea Nimak^{1,2}, Ančica Sečan³, Boris Dorbić¹,
Ana Matin⁴, Duška Ćurić⁵, Tajana Krička⁴**

izvorni znanstveni rad (original scientific paper)

doi: 10.32779/gf.5.1-2.2

Citiranje/Citation⁶

Abstract

The Rapid Alert System for Food and Feed (RASFF) is designed to respond promptly to the health risks associated with food, food contact materials or feed by enabling fast exchange of information between bodies and institutions involved in the system. Mycotoxins, secondary metabolites produced by moulds, are common contaminants found in cereals and cereal-based product all over the world that can be harmful to human (and animal) health. The aim of this study was to analyse RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019. All data were downloaded from the RASFF database (RASFF portal) and processed in MS Excel 2010. The collected data provided information on the: notifying country, country(ies) of origin and distribution of the contaminated product, notification basis, notification type, risk decision, distribution status, action taken, type of mycotoxin and specific cereal or cereal-based product in which the mycotoxin has been determined. Nearly half of the reported food products originated from Italy, Pakistan, India, Serbia and Sri Lanka. More than half notifications were published by Germany, Switzerland, Italy and Belgium. Only in less than one-fifth of the notifications the country of origin of the contaminated product was also the notifying country. Contaminated products in more than two-thirds of cases were maize, rice and rye grains and their products. Aflatoxin B1 was the most frequent mycotoxin, present in more than two-fifths of contaminated cereals and cereal-based products. The majority of the notifications were classified as alert notifications and a large majority of total number of notifications were of serious risk. Regarding

¹ Veleučilište "Marko Marulić" u Kninu, Petra Krešimira IV 30, 22300 Knin, Republika Hrvatska

*E -mail: emilija.friganovic@veleknin.hr (Corresponding author)

² Graduated Food technology student

³ Udruga Futura Šibenik, Bana Josipa Jelačića 13 a, 22000 Šibenik, Republika Hrvatska

⁴ Agronomski fakultet Sveučilišta u Zagrebu, Svetošimunska cesta 25, 10000 Zagreb, Republika Hrvatska

⁵ Prehrambeno-biotehnološki fakultet Sveučilišta u Zagrebu, Pierottijeva 6, 10000 Zagreb, Republika Hrvatska

⁶ Friganović, E., Nimak, A., Sečan, A., Dorbić, B., Matin, A., Ćurić, D., Krička, T. (2022). Analysis of RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019. *Glasilo Future*, 5(5-6), 15–36.

the distribution status, over two-fifths of contaminated products were distributed to other member countries and in almost half of the notifications contaminated products were withdrawn or recalled.

Key words: RASFF, notifications, cereals and cereal-based products, mycotoxins.

Introduction

The Rapid Alert System for Food and Feed (RASFF), run by the European Commission, is designed to respond promptly to the health risks associated with food, food contact materials or feed by enabling fast exchange of information between bodies and institutions involved in the system which in case of health risk initiate an immediate notification procedure (EC, 2020a; EC 2020b). Mycotoxins are secondary metabolites produced by moulds and are common contaminants of food and feed, found in cereals all over the world (Peraica et al. 2002; Pleadin et al., 2017). The production of mycotoxins is greatly influenced by environmental factors and physical and chemical properties of cereals too (Delaš, 2010; Cvjetković, 2014). The most significant mycotoxin producing moulds, especially on cereals, are species from the genera *Penicillium*, *Aspergillus* and *Fusarium* (Jašić, 2009; Cvjetković, 2014). Mycotoxins like aflatoxins, ochratoxin A, trichothecenes type A and B, fumonisins, zearalenone, ergot alkaloids and *Alternaria* toxins are commonly detected in cereal grains and their high levels have been reported in cereal grains and cereal-based products (van den Brand and Bulder, 2020). Mycotoxins can accumulate in the body through a longer period of consumption of lower concentrations of mycotoxin-contaminated food, or can be ingested with a single meal with a higher concentration of mycotoxins, both resulting in mycotoxicosis, chronic or acute, respectively. Mycotoxins can have cytotoxic, carcinogenic, mutagenic, genotoxic, teratogenic, immunotoxic, hematotoxic, hepatotoxic, nephrotoxic and dermatotoxic effects to humans and animals (Jašić, 2009; Delaš, 2010). Aflatoxins are produced by some moulds of the genus *Aspergillus*, *Penicillium* and *Fusarium* (Delaš, 2010). They represent a group of 20 related compounds, among which the most significant representatives are aflatoxins B1, B2, G1, G2, M1 and M2, of which aflatoxin B1 is a contaminant of various foods, very potent toxin, carcinogenic and genotoxic substance, and there is no actual safe level of intake (Peraica and Rašić, 2012; EC, 2020b). Ochratoxin A is produced by fungi of the genus *Aspergillus* and *Penicillium* and found as a contaminant in various foods. It is a not confirmed genotoxic carcinogen (EC, 2017) but is classified as "possibly carcinogenic to humans" and highly harmful to human health. *Fusarium* mould growth is typically linked to cereal products. The toxins produced are known as fumonisins, a group of 15 compounds of which three are the most common: fumonisins, B1, B2 and B3. The legal limits for these toxins are much higher than those for other mycotoxins because of their relatively lower toxicity (Delaš, 2010; EC, 2017). Type A trichothecene mycotoxins, such as T-2 toxin and its main metabolite HT-2 toxin, are produced by *Fusarium* moulds and are primarily found in cereals and cereal-based products and are commonly more toxic than type B trichothecenes, such as deoxynivalenol (DON) (Pleadin et al., 2017; Arcella et

al., 2017). Zearalenone is mycotoxin produced by several species of *Fusarium* moulds. It has significant effects on female reproduction, causing hyperestrogenism, but it also has an impact on the male reproductive system. Zearalenone is classified in IARC group⁷ 3 but recent reports indicate that it poses a serious threat to human health (Gupta et al., 2018). Preventing the growth of moulds as well as the formation of mycotoxins can be achieved by applying a series of measures of good agricultural practice and good production practice (pre-harvest, harvest and post-harvest measures) (Delaš, 2010; Cvjetković, 2014). Physical and chemical methods of food and feed decontamination could be applied as well as processing that might have a different effect on the degradation, transformation, and modification of mycotoxins (Peraica et al. 2002; Sarmast et al., 2021). All decontamination techniques of food and feed, which are far from ideal due to possible occurrence of mycotoxin residues and metabolites as well as food and feed degradation, raise production costs and ought to only be used when preventive agro-technical measures, crucial for crop protection against contamination by mycotoxins, have failed (Peraica et al. 2002). According to European Commission (EC, 2016; EC, 2017; EC, 2019b; EC, 2020b) mycotoxins are the most reported type of hazard for products from non-member countries. Only for the year 2017 the number of notifications on pathogenic micro-organisms in food from non-member countries was higher than the number on mycotoxin contamination reported cases (EC, 2019a). The aim of this study was to analyse RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019.

Materials and methods

All data on notifications for the presence of mycotoxins in cereals and cereal-based products were downloaded from the RASFF portal database (EC, 2020c) and processed in MS Excel 2010 (univariate descriptive statistics) (Microsoft Corporation). The search criteria were as follows: "Product type: food", "Hazard category: mycotoxins", "Notified from: 01/01/2015", "Notified till: 31/12/2019" and "Product category: Cereals and bakery products". The collected data provided information on the: notifying country, country(ies) of origin and distribution of the contaminated product, notification basis, notification type, risk decision, distribution status, action taken, type of mycotoxin and specific cereal or cereal-based product in which the mycotoxin has been determined.

Results and discussion

In the period from 01/01/2015 to 31/12/2019 a total of 132 RASFF notifications were published on cereals and cereal-based products contaminated with mycotoxins. Germany was notifying country in 16.7 % of the published notifications, followed by Switzerland (15.9 %), Italy (11.4 %) and Belgium

⁷ International Agency for Research on Cancer: Group 1: carcinogenic; Group 2A: probably carcinogenic; Group 2B: possibly carcinogenic; Group 3: not classifiable; Group 4: probably not carcinogenic.

(9.1 %) what makes them notifying countries in more than half (53.1 %) of cases. Other countries that participated as notifying countries in more than 5% of published notifications each were Luxembourg (7.6 %), Slovenia (6.8 %) and France (5.3 %) (Table 1.). Contaminated products in question originated in 16 RASFF member countries and 16 RASFF non-member countries. The country of origin of cereals and cereal-based products contaminated with mycotoxins in 15.2 % of notifications was Italy, then Pakistan, India, Serbia and Sri Lanka in 9.1 %, 8.3 %, 8.3 % and 7.6 % of notifications, respectively. Only in 18.9 % of total notifications the country of origin of the contaminated product was also the notifying country. If we observe the same only for RASFF member countries, the result is better, 36.2 %, but still indicative suggesting that public health threats were not recognized in the shortest timeframe possible. In 8.3 % of cases two countries were countries of origin of the contaminated product and in 1.5 % of cases three countries were countries of origin. In 1.5 % of cases the county of origin of contaminated product was not determined (Table 2.).

Table 1. RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019 by year and notifying country.

Notifying country		Year and number of notifications					Total	
		2015	2016	2017	2018	2019	No.	%
1. Austria		0	1	0	0	1	2	1.5
2. Belgium		5	0	2	2	3	12	9.1
3. Croatia		2	0	0	1	1	4	3.0
4. Czech Republic		0	0	1	0	0	1	0.8
5. Denmark		0	0	2	0	1	3	2.3
6. Finland		1	1	0	2	0	4	3.0
7. France		3	0	2	0	2	7	5.3
8. Germany		3	6	2	7	4	22	16.7
9. Hungary		0	1	0	2	2	5	3.8
10. Ireland		0	0	1	0	0	1	0.8
11. Italy		4	3	3	2	3	15	11.4
12. Luxembourg		4	5	0	0	1	10	7.6
13. Malta		1	0	0	0	0	1	0.8
14. Netherlands		0	1	0	0	0	1	0.8
15. Poland		1	0	1	3	4	9	6.8
16. Portugal		0	0	0	0	1	1	0.8
17. Slovakia		1	0	0	0	0	1	0.8
18. Slovenia		2	3	2	0	2	9	6.8
19. Spain		0	0	0	1	0	1	0.8
20. Sweden		0	1	0	0	0	1	0.8
21. Switzerland		3	3	6	7	2	21	15.9
22. United Kingdom		1	0	0	0	0	1	0.8
Total	No.	31	25	22	27	27	132	100
	%	23.5	18.9	16.7	20.5	20.5	100	

Table 2. Countries of origin of cereals and cereal-based products contaminated with mycotoxins in RASFF notifications in the period from 01/01/2015 to 31/12/2019 (% of cases).

Country of origin	% of cases
1. Argentina	0.8
2. Austria	0.8
3. Belgium	4.5
4. Bosnia and Herzegovina	0.8
5. Canada	1.5
6. Czech Republic	6.1
7. Ethiopia	0.8
8. France	5.3
9. Germany	6.1
10. Ghana	2.3
11. Greece	0.8
12. Hungary	2.3
13. India	8.3
14. Italy	15.2
15. Kosovo	0.8
16. Lithuania	0.8
17. Myanmar	1.5
18. Netherlands	1.5
19. Pakistan	9.1
20. Poland	5.3
21. Portugal	4.5
22. Romania	0.8
23. Russia	0.8
24. Serbia	8.3
25. Sri Lanka	7.6
26. Sweden	0.8
27. Switzerland	2.3
28. Syria	0.8
29. Thailand	0.8
30. Turkey	2.3
31. United Kingdom	3.0
32. United States of America	2.3
33. Unknown origin	1.5

RASFF notifications on the presence of mycotoxins in cereals and cereal-based products in the period from 01/01/2015 to 31/12/2019 mostly referred to maize and maize-based products (31.1 %), rice and rice-based products (30.3 %), then rye and rye-based products (8.3 %), wheat and wheat-based products (7.6 %), oat and oat-based products (4.5 %), buckwheat and buckwheat-based products (3.8 %), barley and barley-based products (2.3 %) and millet flour (0.8 %). In the remaining cases of contaminated cereal-based products the exact cereal was not specified (RASFF Portal, 2020). Aflatoxin B1 was the most frequent mycotoxin, present in 43.2 % of cases of contaminated cereals and cereal-based products, followed by ochratoxin A (28.8 % of cases), deoxynivalenol (DON) (18.9 % of cases), fumonisins (12.1 % of cases), zearalenone (3.8 % of cases) and T-2 with HT-2 toxin (3.8 % of cases). In addition to the already mentioned T-2 toxin and its metabolite HT-2 toxin, in ten more cases

food products were contaminated with two mycotoxins (aflatoxin B1 + ochratoxin A; aflatoxin B1 + fumonisins; DON + ochratoxin A; DON + fumonisins; DON + zearalenone) (Table 3.).

Table 3. Mycotoxins present in cereals and cereal-based products according to RASFF notifications in the period from 01/01/2015 to 31/12/2019 (% of cases).

Mycotoxin	% of cases		
	Total	In specific cereal or cereal-based products	
1. Aflatoxin B1	43.2	Rice and rice-based products	26.5
		Maize and maize-based products	11.4
		Biscuits and pastry	2.3
		Wheat-based products	0.8
		Millet flour	0.8
		Barley	0.8
		Muesli	0.8
2. Ochratoxin A	28.8	Rye and rye-based products	8.3
		Rice and rice-based products	4.5
		Buckwheat and buckwheat-based products	3.8
		Wheat and wheat-based products	3.8
		Maize and maize-based products	1.5
		Barley-based products	1.5
		Oat and oat-based products	1.5
		Breakfast cereals	1.5
		Porridge	1.5
		Bread crumbs	0.8
3. Deoxynivalenol (DON)	18.9	Maize and maize-based products	9.8
		Wheat and wheat-based products	5.3
		Oat and oat-based products	1.5
		Breakfast cereals	1.5
		Bread crumbs	0.8
4. Fumonisins	12.1	Maize and maize-based products	12.1
5. Zearalenone	3.8	Maize-based products	3.0
		Oat muesli	0.8
6. T-2 and HT-2 toxin	0.8	Oat flour	0.8

The majority of RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019 were classified as alert notifications (59.1 %) and 90.2 % of total number of notifications were of serious risk. Nearly half of the mycotoxin notifications were based on official controls on the market (46.2 %), 29.5 % were based on border control and 23.5 % were based on company's own check. Regarding the distribution status, 43.2 % of contaminated products were distributed to other member countries and in 47.0 % of the notifications contaminated products were withdrawn or recalled (Table 4.).

Table 4. RASFF notifications on cereals and cereal-based products contaminated with mycotoxins in the period from 01/01/2015 to 31/12/2019 by notification type, risk decision, notification basis, distribution status and action taken.

Notification type / Total	Risk decision/ Total	Notification basis/ Total	Distribution status and Action taken
Alert notification (78; 59.1 %)	Serious (75)	Official control on the market (41)	Distribution restricted to notifying country (7) No distribution from notifying country (4) Distribution to other member countries (30)
			Destruction (1) Detained by operator (2) Informing recipient(s) (2) Official detention (1) Public warning - press release (1) Re-dispatch (2) Return to consignor (2) Recall from consumers (19) Withdrawal from recipient(s) (1) Withdrawal from the market (10)
		Company's own check (27)	Distribution restricted to notifying country (8) Distribution to other member countries (15) No distribution from notifying country (3) No distribution to notifying country (1)
			Destruction (1) Detained by operator (3) Informing authorities (1) Informing recipient(s) (3) No action taken (1) Official detention (1) Recall from consumers (5) Re-dispatch (2) Return to consignor (1) Use in feed (1) Withdrawal from the market (7) ND (1)
		Border control (7)	Distribution to other member countries (6) Distribution restricted to notifying country (1)
			Informing consignor (1) Informing recipient(s) (1)
			No action taken (2) Official detention (1)
			Recall from consumers (1) Use for other purpose than food/feed (1)
	Not Serious (0)	-	-
	Undecided (3)	Official control on the market (2)	Distribution restricted to notifying country (1) No distribution from notifying country (1) Recall from customers (1) Return to consignor (1)
		Company's own check (1)	Distribution to other member countries (1) Informing recipients (1)
Border rejection (26; 19.7 %)	Serious (24)	Border control (24)	Product allowed to travel to destination under customs seals (6) Product not (yet) placed on the market (18) Destruction (4) Import not authorised (1)

Notification type / Total	Risk decision/ Total	Notification basis/ Total	Distribution status and Action taken
			Official detention (6) Physical/chemical treatment (1) Placed under customs seals (3) Re-dispatch (7) Return to consignor (2)
	Not serious (1)	Border control (1)	Product allowed to travel to destination under customs seals (1) Placed under customs seals (1)
	Undecided (1)	Border control (1)	Product allowed to travel to destination under customs seals (1) Use for other purpose than food/feed (1)
	Serious (20) (21; 15.9 %)	Official control on the market (13)	Distribution restricted to notifying country (10) Distribution to non-member countries (1) Product (presumably) no longer on the market (2) No stock left (1) Public warning - press release (1) Recall from consumers (5) Withdrawal from the market (4) ND (2)
			Distribution to non-member countries (1) Product (presumably) no longer on the market (1) Official detention (1) Public warning - press release (1)
			Distribution restricted to notifying country (5) Official detention (1) Recall from consumers (3) Withdrawal from the market (1)
		Company's own check (2)	Distribution to non-member countries (1) Product (presumably) no longer on the market (1) Official detention (1) Public warning - press release (1)
		Border control (5)	Distribution restricted to notifying country (5) Official detention (1) Recall from consumers (3) Withdrawal from the market (1)
	Not Serious (0)	-	-
	Undecided (1)	Border control (1)	Distribution restricted to notifying country (1) Official detention (1)
Information notification for follow-up (7; 5.3 %)	Serious (0)	-	-
	Not Serious (1)	Consumer complaint (1)	Distribution to other member countries (1) No action taken (1)
	Undecided (6)	Official control on the market (5)	Distribution to other member countries (4) No distribution from notifying country (1) Destruction (1) Withdrawal from the market (4)
			Distribution restricted to notifying country (1) Recall from consumers (1)
		Company's own check (1)	Distribution restricted to notifying country (1) Recall from consumers (1)
Total	Total	Total	Total
Alert notification (59.1 %)	Serious (90.2 %)	Official control on the market (46.2 %)	Distribution restricted to notifying country (25.8 %) Distribution to non-member countries (2.3 %) Distribution to other member countries (43.2 %) Informing recipients (0.8 %) No distribution from notifying country (6.8 %) No distribution to notifying country (0.8 %) Product (presumably) no longer on the market (2.3 %)
Border rejection (19.7 %)	Not Serious (1.5 %)	Company's own check (23.5 %)	
Information notification for attention (15.9 %)	Undecided (8.3 %)	Border control (29.5 %)	

Notification type / Total	Risk decision/ Total	Notification basis/ Total	Distribution status and Action taken
Information notification for follow-up (5.3 %)		Consumer complaint (0.8 %)	Product allowed to travel to destination under customs seals (4.5 %) Product not (yet) placed on the market (13.6 %) Total Destruction (5.3 %) Detained by operator (3.8 %) Import not authorised (0.8 %) Informing authorities (0.8 %) Informing consignor (0.8 %) Informing recipient(s) (5.3 %) No action taken (3.0 %) No stock left (0.8 %) Official detention (9.1 %) Physical/chemical treatment (0.8 %) Placed under customs seals (3.0 %) Public warning - press release (2.3 %) Recall from customers (26.5 %) Re-dispatch (8.3 %) Return to consignor (4.5 %) Use for other purpose than food/feed (1.5 %) Use in feed (0.8 %) Withdrawal from recipient(s) (0.8 %) Withdrawal from the market (19.7 %) ND (2.3 %)

Note: ND = no data available;

Conclusion

In the period from 01/01/2015 to 31/12/2019 a total of 132 RASFF notifications were published on cereals and cereal-based products contaminated with mycotoxins. Nearly half of the reported food products originated from Italy (15.2 %), Pakistan (9.1 %), India (8.3 %), Serbia (8.3 %) and Sri Lanka (7.6 %). More than half notifications were published by Germany (16.7 %), Switzerland (15.9 %), Italy (11.4 %) and Belgium (9.1 %). Only in less than one-fifth of the notifications the country of origin of the contaminated product was also the notifying country suggesting that public health threats were not recognized in the shortest timeframe possible. Contaminated products in more than two-thirds of cases were maize and maize-based products (31.1 %), rice and rice-based products (30.3 %), and rye and rye-based products (8.3 %). Aflatoxin B1 was the most frequent mycotoxin, present in 43.2 % of cases of contaminated cereals and cereal-based products. The majority of the notifications were classified as alert notifications (59.1 %) and 90.2 % of total number of notifications were of serious risk. Nearly half of the mycotoxin notifications were based on official controls on the market (46.2 %). Regarding the distribution status, 43.2 % of contaminated products were distributed to other member countries, which is worrying, as well is the fact that contaminated products were virtually available to consumers. In 47.0 % of the notifications, contaminated products were

withdrawn or recalled. We will refer to the conclusion of Friganović et al. (2019) that the aforementioned does not cast doubt upon RASFF system's efficacy in responding rapidly to health threats, but highlights the need to strengthen the preventive role of the competent authorities and food business operators themselves.

Acknowledgment

The paper was prepared using some of the results of a final thesis of graduated Food technology student Antea Nimak (see References).

References

- Arcella, D., Gergelova, P., Innocenti, M. L., Steinkellner, H. (2017). Scientific report on human and animal dietary exposure to T-2 and HT-2toxin. *EFSA Journal* 15(8), 4972, 57 pp. doi: 10.2903/j.efsa.2017.4972.
- Cvjetković, B. (2014). Risk management of mycotoxins begins in the field. *Glasilo biljne zaštite*, 14 (4), 317–328.
- Delaš, F. (2010.). Mikrobni Toksini. U: Hengl, B. (ur.), *Kemijske i fizikalne opasnosti u hrani* (31–48). Hrvatska agencija za hranu, Osijek.
- European Commission (2016). RASFF – 2015 annual report. Luxembourg: Publications Office of the European Union.
- European Commission (2017). RASFF – 2016 annual report. Luxembourg: Publications Office of the European Union.
- European Commission (2019a). RASFF – 2017 annual report. Luxembourg: Publications Office of the European Union.
- European Commission (2019b). RASFF – 2018 annual report. Luxembourg: Publications Office of the European Union.
- European Commission (EC) (2020a). RASFF – Food and Feed Safety Alerts, available at: https://ec.europa.eu/food/safety/rasff_en (accessed: 19/05/2020).
- European Commission (2020b). RASFF – 2019 annual report. Luxembourg: Publications Office of the European Union.

European Commission (EC) (2020c). RASFF Portal – online edition: available at: <https://webgate.ec.europa.eu/rasff-window/portal/?event=SearchForm&cleanSearch=1> (accessed: 19/05/2020).

1. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.4497
(accessed: 19/05/2020) Bruxelles: European Commission.
2. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.4400
(accessed: 19/05/2020) Bruxelles: European Commission.
3. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.4329
(accessed: 19/05/2020) Bruxelles: European Commission.
4. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.4247
(accessed: 19/05/2020) Bruxelles: European Commission.
5. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.4185
(accessed: 19/05/2020) Bruxelles: European Commission.
6. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.4182
(accessed: 19/05/2020) Bruxelles: European Commission.
7. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.4006
(accessed: 19/05/2020) Bruxelles: European Commission.
8. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.3707
(accessed: 19/05/2020) Bruxelles: European Commission.
9. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.3610
(accessed: 19/05/2020) Bruxelles: European Commission.
10. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.3315
(accessed: 19/05/2020) Bruxelles: European Commission.
11. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.3158
(accessed: 19/05/2020) Bruxelles: European Commission.

RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.2843

(accessed: 19/05/2020) Bruxelles: European Commission.

13. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.2581

(accessed: 19/05/2020) Bruxelles: European Commission.

14. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.2263

(accessed: 19/05/2020) Bruxelles: European Commission.

15. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.2263

(accessed: 19/05/2020) Bruxelles: European Commission.

16. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.1880

(accessed: 19/05/2020) Bruxelles: European Commission.

17. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.1146

(accessed: 19/05/2020) Bruxelles: European Commission.

18. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.1085

(accessed: 19/05/2020) Bruxelles: European Commission.

19. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.0944

(accessed: 19/05/2020) Bruxelles: European Commission.

20. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.0814

(accessed: 19/05/2020) Bruxelles: European Commission.

21. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.0812

(accessed: 19/05/2020) Bruxelles: European Commission.

22. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.0774

(accessed: 19/05/2020) Bruxelles: European Commission.

23. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.0676

(accessed: 19/05/2020) Bruxelles: European Commission.

24. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.0680
(accessed: 19/05/2020) Bruxelles: European Commission.
25. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.0496
(accessed: 19/05/2020) Bruxelles: European Commission.
26. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.0129
(accessed: 19/05/2020) Bruxelles: European Commission.
27. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.3653
(accessed: 19/05/2020) Bruxelles: European Commission.
28. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.3558
(accessed: 19/05/2020) Bruxelles: European Commission.
29. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.3508
(accessed: 19/05/2020) Bruxelles: European Commission.
30. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.3506
(accessed: 19/05/2020) Bruxelles: European Commission.
31. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.3409
(accessed: 19/05/2020) Bruxelles: European Commission.
32. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2946
(accessed: 19/05/2020) Bruxelles: European Commission.
33. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2865
(accessed: 19/05/2020) Bruxelles: European Commission.
34. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2846
(accessed: 19/05/2020) Bruxelles: European Commission.
35. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2844
(accessed: 19/05/2020) Bruxelles: European Commission.

36. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2659
(accessed: 19/05/2020) Bruxelles: European Commission.
37. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2652
(accessed: 19/05/2020) Bruxelles: European Commission.
38. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2507
(accessed: 19/05/2020) Bruxelles: European Commission.
39. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2393
(accessed: 19/05/2020) Bruxelles: European Commission.
40. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2226
(accessed: 19/05/2020) Bruxelles: European Commission.
41. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.2077
(accessed: 19/05/2020) Bruxelles: European Commission.
42. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.1802
(accessed: 19/05/2020) Bruxelles: European Commission.
43. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.1598
(accessed: 19/05/2020) Bruxelles: European Commission.
44. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.1571
(accessed: 19/05/2020) Bruxelles: European Commission.
45. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.1397
(accessed: 19/05/2020) Bruxelles: European Commission.
46. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.0977
(accessed: 19/05/2020) Bruxelles: European Commission.
47. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.0695
(accessed: 19/05/2020) Bruxelles: European Commission.

48. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.0575
(accessed: 19/05/2020) Bruxelles: European Commission.
49. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.0267
(accessed: 19/05/2020) Bruxelles: European Commission.
50. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.0176
(accessed: 19/05/2020) Bruxelles: European Commission.
51. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.0111
(accessed: 19/05/2020) Bruxelles: European Commission.
52. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2018.0073
(accessed: 19/05/2020) Bruxelles: European Commission.
53. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.2228
(accessed: 19/05/2020) Bruxelles: European Commission.
54. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.CEY
(accessed: 19/05/2020) Bruxelles: European Commission.
55. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.2065
(accessed: 19/05/2020) Bruxelles: European Commission.
56. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.1411
(accessed: 19/05/2020) Bruxelles: European Commission.
57. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.1298
(accessed: 19/05/2020) Bruxelles: European Commission.
58. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0967
(accessed: 19/05/2020) Bruxelles: European Commission.
59. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0776
(accessed: 19/05/2020) Bruxelles: European Commission.

60. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0737
(accessed: 19/05/2020) Bruxelles: European Commission.
61. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0668
(accessed: 19/05/2020) Bruxelles: European Commission.
62. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0643
(accessed: 19/05/2020) Bruxelles: European Commission.
63. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0628
(accessed: 19/05/2020) Bruxelles: European Commission.
64. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0615
(accessed: 19/05/2020) Bruxelles: European Commission.
65. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0588
(accessed: 19/05/2020) Bruxelles: European Commission.
66. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0519
(accessed: 19/05/2020) Bruxelles: European Commission.
67. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0498
(accessed: 19/05/2020) Bruxelles: European Commission.
68. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0460
(accessed: 19/05/2020) Bruxelles: European Commission.
69. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.AQE
(accessed: 19/05/2020) Bruxelles: European Commission.
70. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0424
(accessed: 19/05/2020) Bruxelles: European Commission.
71. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0353
(accessed: 19/05/2020) Bruxelles: European Commission.

72. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.ALO
(accessed: 19/05/2020) Bruxelles: European Commission.
73. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0172
(accessed: 19/05/2020) Bruxelles: European Commission.
74. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.AEI
(accessed: 19/05/2020) Bruxelles: European Commission.
75. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2017.0105
(accessed: 19/05/2020) Bruxelles: European Commission.
76. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1794
(accessed: 19/05/2020) Bruxelles: European Commission.
77. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1761
(accessed: 19/05/2020) Bruxelles: European Commission.
78. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1531
(accessed: 19/05/2020) Bruxelles: European Commission.
79. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1506
(accessed: 19/05/2020) Bruxelles: European Commission.
80. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1457
(accessed: 19/05/2020) Bruxelles: European Commission.
81. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.BGF
(accessed: 19/05/2020) Bruxelles: European Commission.
82. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1333
(accessed: 19/05/2020) Bruxelles: European Commission.
83. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1245
(accessed: 19/05/2020) Bruxelles: European Commission.

84. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1164
(accessed: 19/05/2020) Bruxelles: European Commission,
85. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1138
(accessed: 19/05/2020) Bruxelles: European Commission.
86. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1137
(accessed: 19/05/2020) Bruxelles: European Commission.
87. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.1139
(accessed: 19/05/2020) Bruxelles: European Commission.
88. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0942
(accessed: 19/05/2020) Bruxelles: European Commission.
89. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.AYV
(accessed: 19/05/2020) Bruxelles: European Commission.
90. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.AYV
(accessed: 19/05/2020) Bruxelles: European Commission.
91. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.AXV
(accessed: 19/05/2020) Bruxelles: European Commission.
92. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.AXR
(accessed: 19/05/2020) Bruxelles: European Commission.
93. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0828
(accessed: 19/05/2020) Bruxelles: European Commission.
94. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0748
(accessed: 19/05/2020) Bruxelles: European Commission.
95. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0613
(accessed: 19/05/2020) Bruxelles: European Commission.

96. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0535
(accessed: 19/05/2020) Bruxelles: European Commission.
97. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0365
(accessed: 19/05/2020) Bruxelles: European Commission.
98. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0317
(accessed: 19/05/2020) Bruxelles: European Commission.
99. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0156
(accessed: 19/05/2020) Bruxelles: European Commission.
100. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.0051
(accessed: 19/05/2020) Bruxelles: European Commission.
101. RASFF Portal –online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2016.ABU
(accessed: 19/05/2020) Bruxelles: European Commission.
102. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1664
(accessed: 19/05/2020) Bruxelles: European Commission.
103. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.BYT
(accessed: 19/05/2020) Bruxelles: European Commission.
104. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1577
(accessed: 19/05/2020) Bruxelles: European Commission.
105. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1564
(accessed: 19/05/2020) Bruxelles: European Commission.
106. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1533
(accessed: 19/05/2020) Bruxelles: European Commission.
107. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1473
(accessed: 19/05/2020) Bruxelles: European Commission.

108. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1339
(accessed: 19/05/2020) Bruxelles: European Commission.
109. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1310
(accessed: 19/05/2020) Bruxelles: European Commission.
110. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1307
(accessed: 19/05/2020) Bruxelles: European Commission.
111. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1281
(accessed: 19/05/2020) Bruxelles: European Commission.
112. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1275
(accessed: 19/05/2020) Bruxelles: European Commission.
113. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.BPI
(accessed: 19/05/2020) Bruxelles: European Commission.
114. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1260
(accessed: 19/05/2020) Bruxelles: European Commission.
115. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1259
(accessed: 19/05/2020) Bruxelles: European Commission.
116. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1130
(accessed: 19/05/2020) Bruxelles: European Commission.
117. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1087
(accessed: 19/05/2020) Bruxelles: European Commission.
118. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1056
(accessed: 19/05/2020) Bruxelles: European Commission.
119. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.1030
(accessed: 19/05/2020) Bruxelles: European Commission.

120. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0928
(accessed: 19/05/2020) Bruxelles: European Commission.
121. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0791
(accessed: 19/05/2020) Bruxelles: European Commission.
122. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.AZV
(accessed: 19/05/2020) Bruxelles: European Commission.
123. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.AZN
(accessed: 19/05/2020) Bruxelles: European Commission.
124. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0727
(accessed: 19/05/2020) Bruxelles: European Commission.
125. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.AZG
(accessed: 19/05/2020) Bruxelles: European Commission.
126. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0666
(accessed: 19/05/2020) Bruxelles: European Commission.
127. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0587
(accessed: 19/05/2020) Bruxelles: European Commission.
128. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0358
(accessed: 19/05/2020) Bruxelles: European Commission.
129. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0252
(accessed: 19/05/2020) Bruxelles: European Commission.
130. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0171
(accessed: 19/05/2020) Bruxelles: European Commission.
131. RASFF Portal – online edition – notification – https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0167
(accessed: 19/05/2020) Bruxelles: European Commission.

132. RASFF Portal – online edition – notification –https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2015.0146

(accessed: 19/05/2020) Bruxelles: European Commission.

Friganović, E., Tokmakčija, N., Sečan Matijaščić, A., Kelava, M., Šarolić, M., Dorbić, B. (2019). *Salmonella* spp. in RASFF notifications involving Croatia in the period from 01/01/2014 to 31/12/2018. *Glasilo Future*, 2(5-6), 24–36.

Gupta, R. C., Mostrom, M. S., Evans, T. J. (2018). Zearalenone. In: Gupta, R. C. (ed.), *Veterinary Toxicology, Basic and Clinical Principles, Third Edition*, (1055–1063). London: Academic Press. doi: 10.1016/B978-0-12-811410-0.00083-0.

Jašić, M. (2009): Toksične tvari u hrani (dostupno na: <https://www.tehnologijahrane.com/enciklopedija/toksicne-tvari-hrani>) (pristupljeno: 25. 05. 2022.)

Microsoft Excel 2010. Redmond, USA: Microsoft Corporation.

Nimak, A. (2020). Analiza RASFF obavijesti o žitaricama i proizvodima na bazi žitarica kontaminiranim mikotoksinima u razdoblju 01. 01. 2015. – 31. 12. 2019., Završni rad, Veleučilište "Marko Marulić" u Kninu.

Peraica, M., Domijan, A., Jurjević, Ž., Cvjetković, B. (2002). Prevention of exposure to mycotoxins from food and feed. *Arhiv za higijenu rada i toksikologiju*, 53 (3), 229-237.

Peraica, M. i Rašić, D. (2012). Acute and chronic human mycotoxicoses. *Krmiva*, 54 (3), 81-87.

Pleadin, J., Vulić, A., Babić, J., Šubarić, D. (2017). The Incidence of T-2 and HT-2 Toxins in Cereals and Methods of their Reduction Practice by the Food Industry. In: Askun, T. (ed.), *Fusarium – Plant Diseases, Pathogen Diversity, Genetic Diversity, Resistance and Molecular Markers*, (9–58). London: IntechOpen Limited. doi: 10.5772/intechopen.71550.

Sarmast, E., Fallah, A. A., Jafari, T., Mousavi Khaneghah, A. (2021). Occurrence and fate of mycotoxins in cereals and cereal-based products: a narrative review of systematic reviews and meta-analyses studies. *Current Opinion in Food Science*, 39(68-75). doi:10.1016/j.cofs.2020.12.013.

van den Brand, A. D., Bulder, A. S. (2020.). An overview of mycotoxins relevant for the food and feed supply chain: using a novel literature screening method. Bilthoven: National Institute for Public Health and the Environment.

Primljeno: 2. lipnja 2022. godine

Received: June 2, 2022

Prihvaćeno: 30. lipnja 2022. godine

Accepted: June 30, 2022