MARIO LEŠNIK – FAKULTETA ZA KMETIJSTVO IN BIOSISTEMSKE VEDE UM

Mikotoksini – možnosti obvladovanja – ukrepi varstva rastlin v razmerju do drugih ukrepov za obvladovanje njihovega pojava in škodljivosti

DELAVNICA GIZ FITOFARMACIJA 2018















V prezentaciji so slike različnih živilskih produktov in opreme iz spletnih virov, ki so uporabljene kot simbolni primeri. Vsebina glede problematike mikotoksinov se ne nanaša natančno na produkt ali opremo nekega podjetja prikazano na sliki. V nekaterih primerih spletni vir ni prikazan, da bralec nebi povezoval vira in obremenjenosti konkretnega izdelka z mikotoksini.


GLIVE MIKOTOKSINE POGOSTO UPORABLJAJO ZA RAZMEJEVANJE ŽIVLJENJSKEGA PROSTORA - ZASTRUPITEV SUBSTRATA DA JE NEUPORABEN ZA DRUGE VRSTE GLIV
Običajno tega ne vidimo - v deževnem letu se to bolje vidi
M. laxa
M. fructigena

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Običajno tega ne vidimo - v deževnem letu se to bolje vidi
Razmejitev med glivami povzročiteljicami mušje pegavosti in sajavosti



Površina sadja in zelenjave je polna gliv - večinoma jih ne vidimo

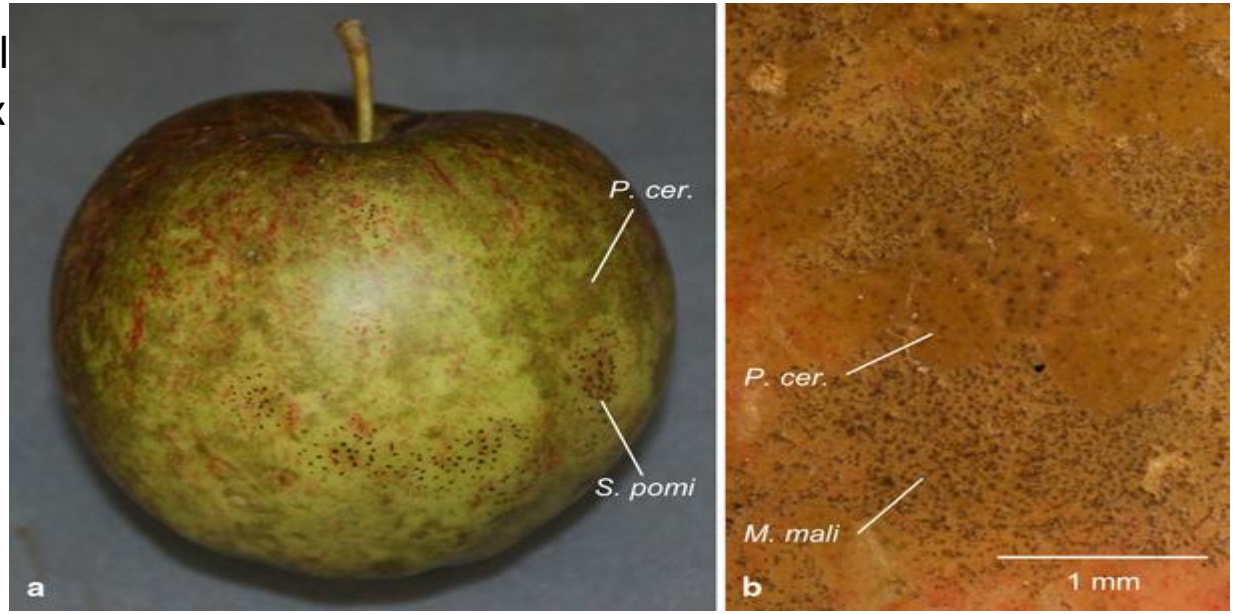



Površina sadja in zelenjave je polna gliv - večinoma jih ne vidimo

- **A Review of Sooty Blotch and Flyspeck Disease in German Organic Apple Production**
- Sooty blotch and flyspeck (SBFS) fungi colonise the surface of a range of fruits, especially apple, without penetrating the cuticle. Economic damage results from the exclusion of severely affected fruit batches from being marketed as table apples. A study of SBFS was conducted in 2007–2012 in the two largest German apple production areas, *i.e*. the Lake Constance and Lower Elbe regions. The absence of this disease complex from orchards under integrated pest management in both regions in all years was explained by the collateral effects of scab and storage-rot sprays with captan and quinone-outside inhibitors (QoI) such as trifloxystrobin. However, SBFS was economically relevant in organically managed orchards, being generally more severe in Southern Germany than in the North. In both regions, *Peltaster cerophilus* was the most frequently isolated SBFS fungus and was chiefly responsible for crop losses. *Cyphellophora sessilis, Microcyclosporella mali* and *Schizothyrium pomi* also contributed to SBFS in some organic orchards, whereas a diversity of additional species was confined to untreated orchards. Evidence was obtained that *P. cerophilus* overwinters within orchards, fruit mummies being one of presumably several colonised plant organs. Infections of young apple fruits were initiated at any time following the end of flowering, and *P. cerophilus* was capable of causing several infection cycles per season by means of conidial inoculum. The colonisation of sheets of waxed paper by *P. cerophilus* indicated that this species does not require fruit leachates for growth. No further expansion of colonies was observed during cold storage; instead, *P. cerophilus* was gradually displaced by other fungi. Differences in the susceptibility of apple varieties to *P. cerophilus* were due to fruit ripening, late-maturing cultivars being most heavily colonised, and to surface properties, varieties with a waxy bloom being conspicuously less strongly colonised than others. This fungus was unable to colonise russeted fruit areas. Repeated spray treatments with lime-sulphur and potassium bicarbonate throughout the season were effective and necessary to control SBFS in organic production. This strategy threatens the fungicide-saving potential offered by scab-resistant apple varieties. Cultural measures against SBFS include summer pruning as well as the manual removal of fruit mummies in winter.

https://link.springer.com/article/10.1007/s10341-016-0266-x

Weber, R., Späth, S., Buchleither, S. et al. Erwerbs-Obstbau (2016) 58: 63. https://doi.org/10.1007/s10341-016-0266-x



NA POVRŠINI SADJA IN ZELENAJVE ŽIVI TISOČE GLIV KATERIH METABOLITOV NE POZNAMO IN JIH OD NEGDAJ VSAKODNEVNO UŽIVAMO





IZLOČKE GLIV UŽIVAMO VSAK DAN

NJIHOVEMU UŽIVANJU SE V POPOLNOSTI NI MOŽNO IZOGNITI

HRANE KI NEBI VSEBOVALA VSAJ MALO MIKOTOKSINOV SKORAJ NI MOŽNO ZAGOTOVITI

EVOLUCIJSKO JE NAŠE TELO DELNO PRILAGOJENO NA UŽIVANJE MIKOTOKSINOV

JASNA MEJA NEŠKODLJIVE IZPOSTAVLJENOSTI MIKOTOKSINOM NI ZNANA

KONCENTRACIJSKE MEJE, KI JIH TRENUTNO IMAMO SO ARBITRARNE
POLITIČNO – TOKSIKOLOŠKE

PRI PESTICIDIH SO TOKSIKOLOŠKI UČINKI BOLJE STESTIRANI - PESTICID Z LASTNOSTMI MIKOTOKSINOV NE MORE PREITI SKOZI REGISTRACIJSKI POSTOPEK



Toxic effects of mycotoxins in humans

M. Peraica,[1] B. Radić,[2] A. Lucić,[3] & M. Pavlović[4]

KADARKOLI LJUDEM ODVZAMEMO VZORCE KRVI SO MIKOTOKSINI DETEKTIRANI PRI VELIKEM DELEŽU VZORCEV



Gerald Holmes, Ca... Polytechnic State University at San Luis Obispo, Bugwood.org

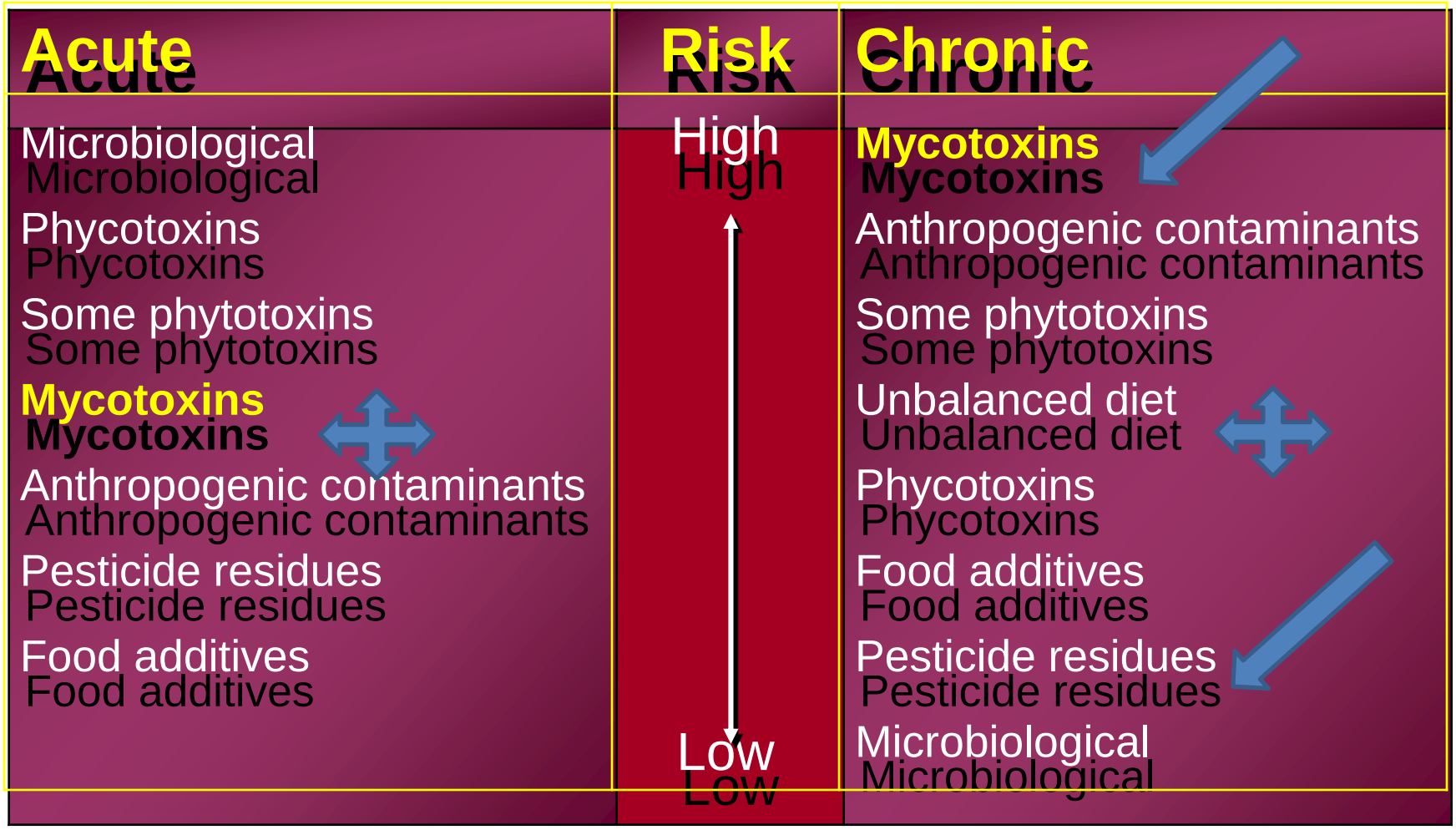
Table 4. **Occurrence of ochratoxin A in human blood samples**[a]

Country	Year	Incidence of positive samples	Mean concentration (ng/ml)	Concentration range of positive samples (ng/ml)	Reference
Bulgaria	1984–90	9/125 (7)[b]		1.0–10.0	*67*
Canada	1994	144/144 (100)	0.88	0.29–2.37	*71*
Croatia	1997				*72*
Zagreb		29/50 (58)	0.26	0.20–1.28	
Rijeka		18/50 (36)		0.20–0.82	
Osijek		50/50 (100)	0.68	0.20–1.65	
Split		27/49 (55)	0.25	0.20–1.39	
Varazdin		24/50 (48)	0.59	0.20–15.9	
Czechoslovakia	1990	35/143 (24)	0.14	0.10–12.6	*73*
Czech Republic	1994	734/809 (91)		0.10–13.7	*74*
	1995	404/413 (98)	0.24	0.10–1.9	
Denmark	1986–88	78/144 (54)	1.8	0.10–13.2	*75*
France	1991–92				*76*
Alsace		97/500 (19)		0.10–12	
Aquitaine		385/2055 (19)		0.10–160	
Rhône-Alpes		75/515 (15)		0.10–4	
Federal Republic of Germany	1977	84/164 (51)	0.4	0.1–4	*77*
	1985	89/141 (63)	0.3	0.1–2	*77*
	1988	142/208 (68)	0.75	0.1–8	*78*
Hungary	1995	291/355 (82)		0.2–10	*79*
	1997	213/277 (77)		0.1–1.4	*80*
Italy	1992	65/65 (100)	0.5	0.1–2	*81*
Japan, Tokyo	1992–96	156/184 (85)	0.068[c]	0.004–0.278	*82*

Umestitev mikotoksinov po lestvici med druge škodljive snovi

The risk of mycotoxins to acute *vs* chronic diseases

In European conditions mycotoxins present the chronic health threat



*Kuiper-Goodman, 1998

PREZENTACIJA GERET J MARAIS

CAMS
Centre for Applied Mycological Studies

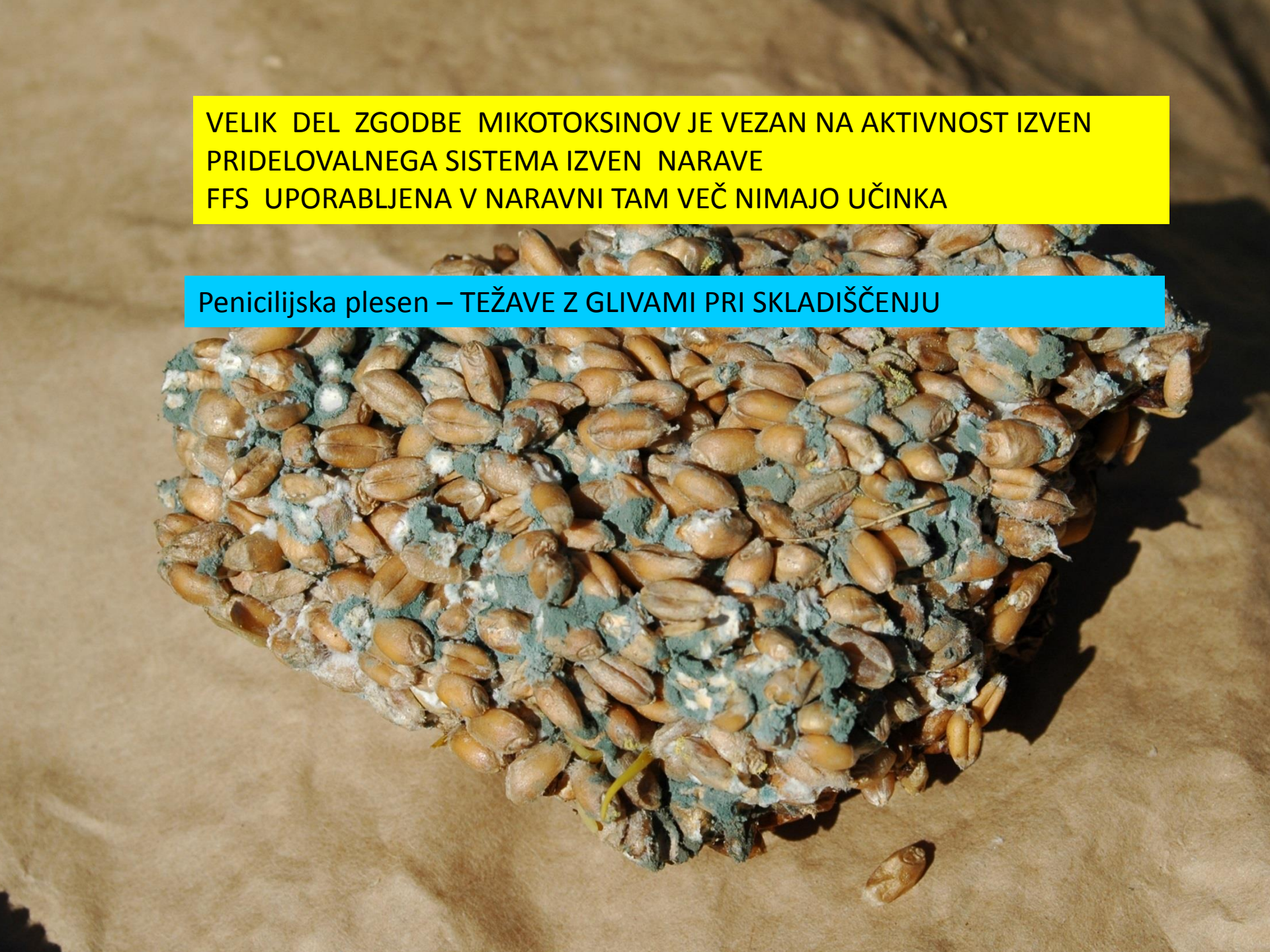
MIKOTOKSINI NISO PRIMERLJIVI PESTICIDOM NITI PO AKUTNI NITI PO KRONIČNI TOKSIKOLOGIJI
NEKAJ PODATKOV ZA LD50 ZA AFLATOKSIN /
PRIMERJALNO GLIFOSAT IMA ZA MIŠI LD50 NAD 5000 MG/KG

Species	Oral LD50/Lethal dose (mg/Kg)
Chick embryo	0.025
Duckling	0.3
Turkey poultry	0.5
Chicken, New Hampshire	2.0
Chicken, Rhode Island	6.3
Sheep	5.0
Rat(male)	7.2
Rat(female)	17.9
Rabbit	0.3
Cat	0.6
Pig	0.6
Guinea pig	1.4
Hamster	10.2
Mouse	9.0
Baboon	2.0

Table 3. Comparative LD50 or lethal values for Aflatoxin B1 (Edds, 1973 &WHO, 1979).

VELIK DEL ZGODBE MIKOTOKSINOV JE VEZAN NA AKTIVNOST IZVEN PRIDELOVALNEGA SISTEMA IZVEN NARAVE
FFS UPORABLJENA V NARAVNI TAM VEČ NIMAJO UČINKA

Penicilijska plesen – TEŽAVE Z GLIVAMI PRI SKLADIŠČENJU



Niso vse glive enako škodljive – kemizem izločkov je zelo različen



V KOLIKŠNI MERI LAHKO NA VSEBNOSTI MIKOTOKSINOV V ŽIVEŽU VPLIVAMO Z UKREPI VARSTVA RASTLIN ?????????

V NEKATERIH PRIMERIH VELIKO

V NEKATERIH PRIMERIH MALO

KOLIKŠEN JE POMEN UPORABE FFS PROTI DRUGIM UKREPOM??

ALI SPREMEMBE V TEHNIKAH VARSTVA RASTLIN POMENIJO VELIKE SPREMEMBE V VSEBNOSTI MIKOTOKSINOV V ŽIVEŽU????



OHRATOKSIN
AFLATOKSIN
FUMONIZIN
PATULIN
CITRININ
MONILIFORMIN

KAPTAN
BOSKALID
FLUOPIRAM
TRIFLOKSISTROBIN
CIPRODINIL
DITIANON



Zmanjšanje možnosti za kemično varstvo rastlin v številnih primerih lahko poveča izpostavljenost mikotoksinom
KRATKOTRAJNOST DELOVANJA AGRO KEMIKALIJ APLICIRANIH V NARAVNEM OKOLJU - KRATKOTRAJNOST VPLIVANJA

Najpomembnejše točke v obvladovanju pojava mikotoksinov
KAJ LAHKO IN KAJ NE MOREMO DOSEČI Z UPORABO FFS?

Zelena veriga:	Rdeča veriga:
Klima in vreme /PRILAGAJANJE	Klima in vreme /PRILAGAJANJE
Pridelovalna tehnika	Pridelovalna tehnika
Varstvo rastlin	Varstvo rastlin
	Endofitne glive
Postopek spravila (vlaga, poškodbe, primesi)	Postopek spravila (vlaga, poškodbe, primesi)
Skladiščenje	Skladiščenje krme
Analiza vhodnih surovin	Ravnanje z živalmi / obremenitve površin
Postopek predelave ali priprave za trg	Higiena živinorejskih obratov Higiena delovnega mesta (inhalatorna izp.)
Ravnanje z živežem v trgovini	Postopki hitrega odkrivanja kontaminacije
Ravnanje z živežem v gospodinjstvu	Postopki hitrega odkrivanja znakov izpostavljenosti živali v hlevih
Tradicionalni postopki priprave nekaterih živil	Postopek predelave ali priprave za trg
Tradicionalni postopki priprave obrokov	Ravnanje z živežem v trgovini
	Ravnanje z živežem v gospodinjstvu
Procesna in namakalna voda	
	Tradicionalni postopki priprave nekaterih živil
Mikrobi uporabljeni za varstvo rastlin	Tradicionalni postopki priprave obrokov



Health threats

Različne poti vnosa mikotoksinov v telo

Humans:

- ingestion of foods contaminated with mycotoxins
- (diseases of immune system, diseases of digestive tract, carcinogenesis, , ….)
- breathing of air contaminated with spores (residences)
- (farm environment – stable, warehouses, machinery - combine at harvest time)
- (allergic diseases of respiratory system, chronic diseases of respiratory system, …)
- skin and eye contact with plant materials contaminated with mycotoxin producing fungi
- (skin allergic reactions, skin disorders and diseases, eye inflammation)









- **Animals:**
- The same threats like at humans
  but at much more expressive level:





- - feeding with contaminated food
- - living in environments with contaminated air
- - bedding with mycotxin contaminated straw
- Reduced productivity of animals:
  (chronic health, reproductive and behavioural disorders)

Dejavniki Izpostavljenost in obsega vpliva na zdravje
Toksikološke razlike med različnimi vrstami mikotoksinov

Dejavniki izpostavljenosti mikotoksinom:	Deležniki:
Profesionalnost dela pridelovalcev	Pridelovalci
Profesionalnost dela v živilski industriji in nadzor	Živilska industrija
Profesionalnost dela trgovcev	Trgovina
Dolžina obravnave v trgovski verigi	Trgovina
Notranji nadzor surovin	Trgovina
Pogostost uživanja bolj ali manj tveganih živil Tudi pogostost uživanja določenih pijač	Potrošnik
Pogostost uživanja živil po pretečenem roku uporabe	Potrošnik
Nestrokovna priprava živil v gospodinjstvu Neustrezni postopki konzerviranja v gospodinstvu	Potrošnik
Procesiranje neustreznega živeža	Potrošnik
Splošen nadzor	RS – inšpekcije
Določanje sprejemljivih mej kontaminacije	Znanstveniki – toksikologi / politiki
Sezonska frekvenca nadzora	RS – inšpekcije

Vsakdanja tvegana ravnanja v gospodinjstvu pri potrošnikih

- TEHNOLOŠKE TEŽAVE
- KLIMATSKE SPREMEMBE



Primernost za uživanje – če izrežemo inficirane dele ŽIVIL ??????????

Burning question: If you cut mould off food, is it then safe to eat?

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ABC Health & Wellbeing By staff writers

Updated 18 May 2017 at 1:55 am

First posted 17 May 2017 at 2:20 am

You're hanging out for a sandwich, but your heart sinks when you find the cheese is sporting a blue and white bloom and the bread is covered in white fluffy spots.



You don't want to waste it, but you don't want to make yourself sick either (Istockphoto:Vasko)

Can you attempt a rescue operation by cutting off the mould or should the whole lot go in the bin?

The answer to some extent depends on how you balance your approach to a potential health risk versus your desire to avoid wasting food.

If the cheese is a hard cheese, it's probably safe just to cut the bad bit off, says Dr Ailsa Hocking, of CSIRO Agriculture and Food.

The bread though, is probably better off thrown away, she believes.

Assessing the risk

It's not just an awful taste you're risking if you eat mouldy food.

Actively growing mould can release toxins into food.

Since the spread of the tiny mould tips is not always visible, it might be hard to know where it (and hence the toxin) is.

So how do you decide what to do when you haven't got a food safety expert on hand?

Two factors that should guide you are the moisture

TOP HEALTH STORIES >



Food

Spoilt rotten: good and bad mould

Some fungal growths add flavour to food while others are toxic. So how do you spot the right kind of rot?

Phil Daoust

Wed 26 Oct 2011 20.59 BST

87 41



▲ Beware growth on soft fruits. Photograph: Alamy

There's something menacing about mould. Not only is it disfiguring, but it threatens to escalate. "Turn your back," it whispers, "and I will spread. Today I'm a few spots on your cheddar, but tomorrow your whole kitchen will be full of fur. You will only escape by burning the house down."

It's not entirely fanciful, this fear. The microscopic fungi that we call mould can survive cold, dry or acidic conditions that make bacteria curl up their toes and die. They spread their threads through everything from meat and fruit to bread, vegetables, cheese and jam. They're the culinary equivalent of

Primernost za uživanje – če izrežemo inficirane dele sadja in zelenjave ???????????

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PREVERITE

Uživanje sadja, ki je okuženo z glivami proizvajalkami mikotoksinov ni priporočljivo
Mikotoksini so pogosto vodotopni in preidejo v tkiva ki ne kažejo znakov naselitve z glivami





Uživanje sadja, ki je okuženo z glivami proizvajalkami mikotoksinov ni priporočljivo
Mikotoksini so pogosto vodotopni in preidejo v tkiva ki ne kažejo znakov naselitve z glivami

Eko sadje - TOLERIRA SE neka zmerna mera naselitve z glivami - hrušev škrlup
KJE JE MEJA UŽITNOSTI ????



SAJAVOST HRUŠK - NASELITEV GLIVIC SAJAVOSTI NA IZTREBKIH (MANA) OD BOLŠICE
KJE JE MEJA UŽITNOSTI ????????



Črnobe pogosto kvarijo kakovost zelenjave (prim. križnice v deževnem vremenu)

Kje je meja užitnosti???



TUKAJ JE MEJA UŽITNOSTI GOTOVO PRESEŽENA



NEUSTREZNO POSUŠENO SADJE IN ZELIŠČA SPADAJO MED BOLJ TVEGAN ŽIVEŽ





Fotografije
spletni viri

NEPROFESIONALNO SUŠENJE VELIKO TVEGANJE ZA POJAV MIKOTOKSINOV

Fotografije spletni viri











Med seboj povezani učinki – večkrat prezrte povezave – TEHNOLOGIJA – KLIMA

NEZMOŽNOST ALI NIZKA UČINKOVITOST ZATIRANJA ŠO	DELEŽNIKI:
Ni registriranih FFS za zatiranje gliv	Industrija FFS, RS, Org Prid, …
Ni registriranih FFS za zatiranje žuželk in pršic, ki imajo vpliv na velikost populacije gliv	Industrija FFS, RS, Org Prid, …
Ni dovoljene uporabe FFS v skladiščenju	Industrija FFS, RS, OrgPrid, …
Registrirana FFS so premalo učinkovita	Industrija FFS
Tehnične težave pri aplikaciji FFS	Industrija STR, Svetovalna služba
Premalo znanja pri uporabi FFS	Producenti znanja in Svetovalna služba
Primanjkljaj informacij v prognostiki (spletni portali za oceno tveganja pojav ŠO in glede določitve izvedbe zatiralnih ukrepov)	Prognostična služba
NEZMOŽNOST ADAPTACIJE PRIDELOVALNE IN PREDELOVALNE TEHNIKE	
Ni ustreznih sort gojenih rastlin	Industrija SEMEN
Ni znanja glede obdelave tal	Producenti znanja in Svetovalna služba
Ni strojne tehnike za ustrezno obdelavo tal	Industrija STR, Sistem podpor
Ni strojne tehnike za spravilo pridelkov	Industrija STR, Sistem podpor
Pomanjkljivosti v strojni tehniki in v opremi v skladišču (SUŠENJE)	Industrija STR, Sistem podpor
Premalo učinkovita procesna tehnika v živilski industriji (odstranitev toksinov)	Živilska industrija – POMANJKANJE SREDSETV ZA INVESTICIJE

Povezava – Ostrinia nubilalis – Fusarium

Below: Red ear rot infection starts at the tip of the ear, just after female flowering. © Elzbieta Czembor, IHAR, Poland. Right: Evidence of European corn borer activity and subsequent symptoms of pink ear rot. © Stephanie Schürch, Agroscope ACW Changins-Wädenswil, Switzerland.







https://extension.entm.purdue.edu/fieldcropsipm/insects/euro-cornborer.php



http://www.thompsonslimited.com/2015/09/03/stalk-rots-corn/

Klimatske spremembe - vprašanje masovnega razvoja gliv rodu Aspergillus na koruzi v septembru in oktobru - neposredna kontaminacija z aflatoksini že pred žetvijo koruze.
Ta pojav je bil v preteklosti redek, danes je pogost.



VPLIV
Diabrotica ???
Rhopalosiphum ???



Povečano tveganje pri poznih hibridih



LIČINKE OREHOVE MUHE – RHAGOLETIS COMPLETA

SLABE MOŽNOSTI ZATIRANJA OREHOVE MUHE - VEČ MIKOTOKSINOV V OREHIH



https://www.researchgate.net/publication/287196762_Invasieve_walnootboorvlieg_Rhagoletis_completa_nu_ook_in_Nederland_Diptera_Tephritidae/figures?lo=1

SLABE MOŽNOSTI ZATIRANJA OREHOVE MUHE - VEČ MIKOTOKSINOV V OREHIH
NAPAKE V TEHNIKI SPRAVILA PRIDELKOV IN V TEHNIKI PRIPRAVE ZA SKLADIŠČENJE



OLJČNA MUHA – DACUS OLEAE



http://www.agraria.org/entomologia-agraria/mosca-dell-olivo.htm



http://www.agripest.net/dacus-olea



SLABE MOŽNOSTI ZATIRANJA OLJČNE MUHE - VEČ MIKOTOKSINOV V OLJČNEM OLJU
AFLATOKSIN
OHRATOKSIN

https://commons.wikimedia.org/wiki/File:CSIRO_ScienceImage_10822_Granary_Weevils_Sitophilus_granarius.jpg



NEZMOŽNOST ZATIRANJA SKLADIŠČNIH ŠKODLJIVCEV

VELIK POJAV GLIV IN MIKOTOKSINOV V SKLADIŠČU





PROBLEMI SLABIH MOŽNOSTI ZATIRANJA ŠKODLJIVCEV, KI LAHKO IMAJO VELIK VPLIV NA POJAV GLIV PRODUCENTK MIKOTOKSINOV
IMAMO TUDI KULTURE Z NA SPLOŠNO SLABIMI MOŽNOSTMI OBVLADOVANJA ŠKODLJIVCEV



NAPAKE V TEHNIKI SPRAVILA PRIDELKOV IN V TEHNIKI PRIPRAVE ZA SKLADIŠČENJE



https://www.aspergillus.org.uk/content/fresh-fruit-fig-niger-infected-calimyrna-fig-smutted-right-fig-and-healthy-fig-left



alamy stock photo
B6H1XY
www.alamy.com





Nekatere tradicionalne tehnike sušenja pred skladiščenjem lahko predstavljajo tveganje za pojav povečanih vsebnosti mikotoksinov







Nekatere tradicionalne tehnike sušenja pred skladiščenjem lahko predstavljajo tveganje za pojav povečanih vsebnosti mikotoksinov



SODOBNE SKLADIŠČNE TEHNIKE
PRIMANJKLJAJ V SLOVENIJI











Tradicionalne tehnike sušenja pred skladiščenjem lahko predstavljajo tveganje za pojav povečanih vsebnosti mikotoksinov v olju

V Sloveniji težave pri sušenju buč

Novi pridelovalci brez kapacitet za sušenje - pridelek se pridela, potem pa pridejo vprašanja kje sušiti





https://www.gettyimages.com/detail/video/farmers-spread-pumpkin-seeds-on-a-road-for-drying-in-the-news-footage/1031373708

NEUSTREZNE TEHNIKE SUŠENJA

MIKOTOKSINI IN DRUGI KONTAMINANTI V BUČNEM OLJU

PREMALO KONTROLIRANO ŽIVILO



Žal je možno tehnike, ki se jih poslužujejo v nerazvitih državah videti tudi v Sloveniji.
Pri sušenju na asfaltu lahko v seme preidejo številne strupene snovi iz naftnih derivatov.

- Health + Science & Technology
- Published: April 21, 2017 **Sunflower seeds traced as source of toxic mold, potent liver carcinogen**
- Contact(s): Layne Cameron , Gale Strasburg , Felicia Wu Michigan State University researchers have sh flower seeds are frequently contaminated with a toxin produced by molds and pose an increased health risk in many come countries worldwide.
- In the current issue of PLoS ONE, the team of scientists documented frequent occurrence of aflatoxin – a toxin produced by Aspergillus molds that commonly infect corn, peanuts, pistachios and almonds – in sunflower seeds and their products. This is one of the first studies to associate aflatoxin contamination with sunflower seeds.
- The study was conducted in Tanzania, but the problem is by no means isolated there. Chronic exposure to aflatoxin causes an estimated 25,000-155,000 deaths worldwide each year, from corn and peanuts alone. Since it is one of the most potent liver carcinogens known, the research to detect and limit its presence in sunflower seeds and their products could help save lives and reduce liver disease in areas where sunflowers and their byproducts are consumed, said Gale Strasburg, MSU food science and human nutrition professor and one of the study's co-authors.
- "These high aflatoxin levels, in a commodity frequently consumed by the Tanzanian population, indicate that local authorities must implement interventions to prevent and control aflatoxin contamination along the sunflower commodity value chain, to enhance food and feed safety in Tanzania," he said. "Follow-up research is needed to determine intake rates of sunflower seed products in humans and animals, to inform exposure assessments and to better understand the role of sunflower seeds and cakes as a dietary aflatoxin source."
- Smallholder farmers in Tanzania grow sunflowers for the seeds, which are sold to local millers who press the seeds for oil and sell it to local consumers for cooking. The rema
- The seeds become infected by Aspergillus flavus or nation has been well studied in other crops, but there is lit
- Juma Mmongoyo, a former MSU food science docto of seeds and cakes in seven regions of Tanzania in 201 cake samples were contaminated with aflatoxins.
- In addition, 14 percent of seeds and 17 percent of c dered safe by the U.S. Food and Drug Administration. Som
- "Billions of people worldwide are exposed to aflato d regularly for contaminants," said Felicia Wu, the Ha n and Agricultural, Food and Resource Economics at MSU Organization on the global burden of foodborne dis at causes the greatest disease burden worldwide."



- To help solve that problem, Wu founded the Center for the Health Impacts of Agriculture. The center tackles global issues, such as antibiotics given to livestock and poultry that seep into soil and nearby bodies of water, and the association between

PREDOLOGO ČAKANJE S SPRAVILOM SONČNIC – RAZVOJ MIKOTOKSIGENIH GLIV NA SEMENU – MIKOTOKSINI V OLJU

PROBLEM SONČNIČNIH TROPIN V PREHRANI ŽIVINOREJI







KLIMATSKE SPREMEMBE – SONČNI OŽIG – GOJIŠČE ZA RAZVOJ GLIV

Izpostavljenost plodov močni sončni pripeki – ožigi

Alternaria, Stemphylium, Pleospora, Cladosporium, …..




Sončni ožig

Stemphylium spp. – NA SONČNEM OŽIGU



Stemphylium spp. – NA SONČNEM OŽIGU





Stemphyllium sp. – stempilijska rjava gniloba hrušk

https://www.google.si/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=2ahUKEwjRuo-0tpzfAhWELewKHS_YAQEQjhx6BAgBEAI&url=https%3A%2F%2Fonlinelibrary.wiley.com%2Fdoi%2Fpdf%2F10.1111%2Fj.1365-2338.2007.01156.x&psig=AOvVaw0xLN_9PtEhJOHKZYszeflw&ust=1544777365277087

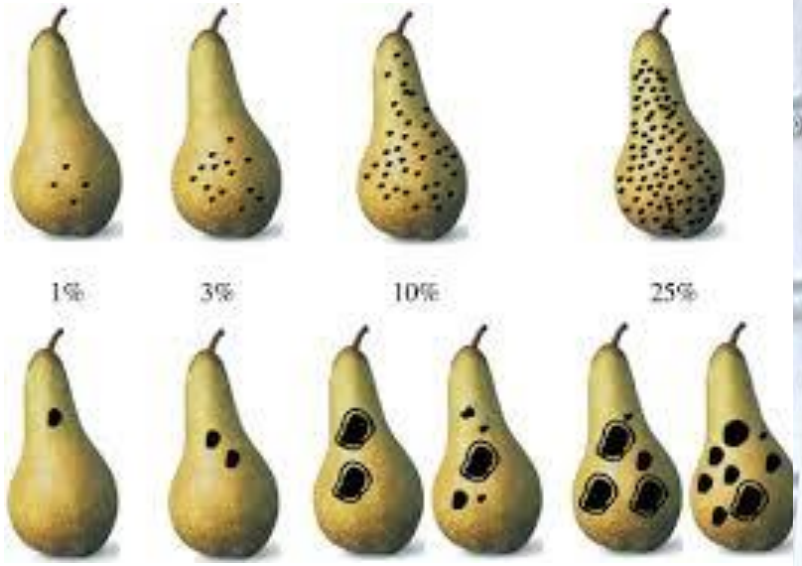
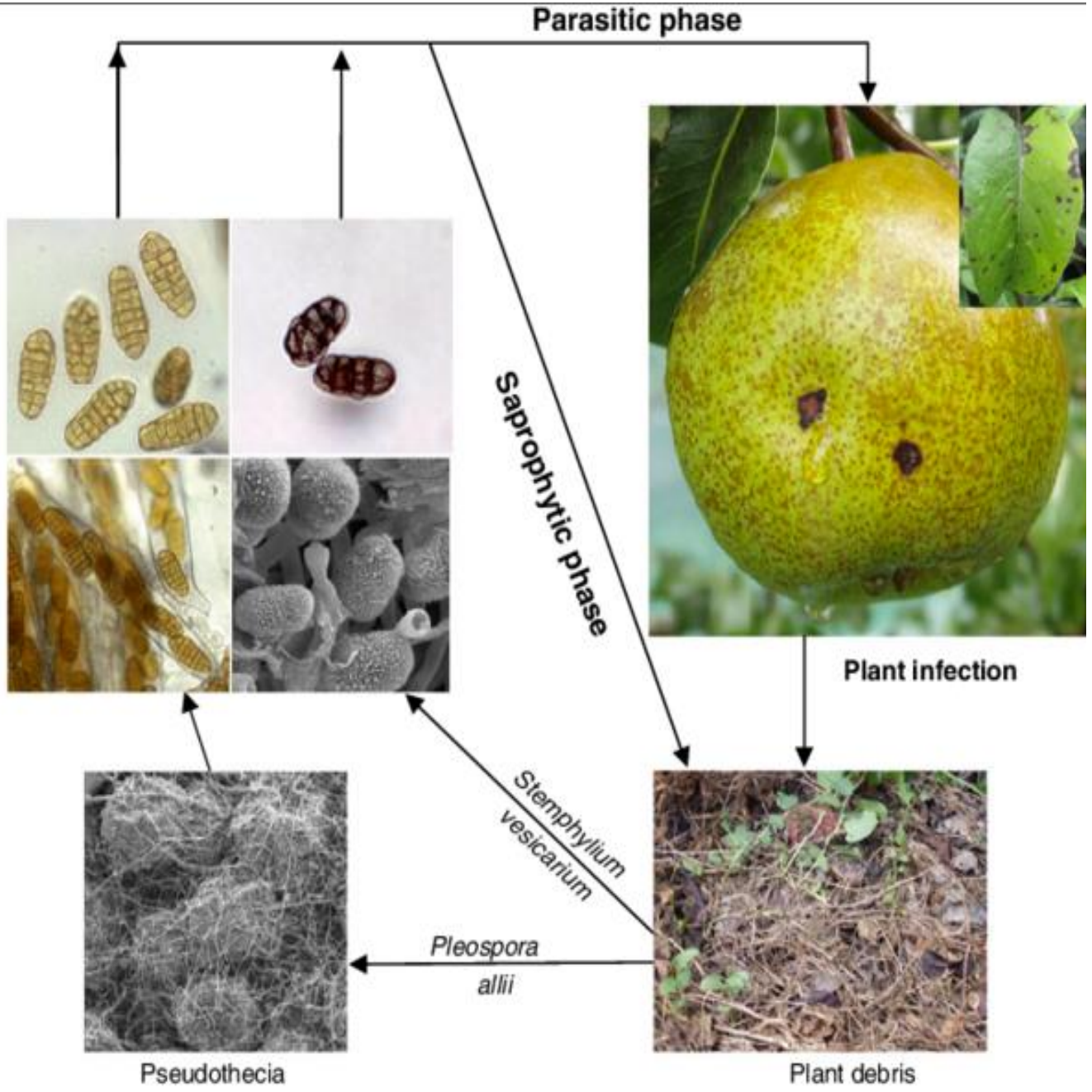


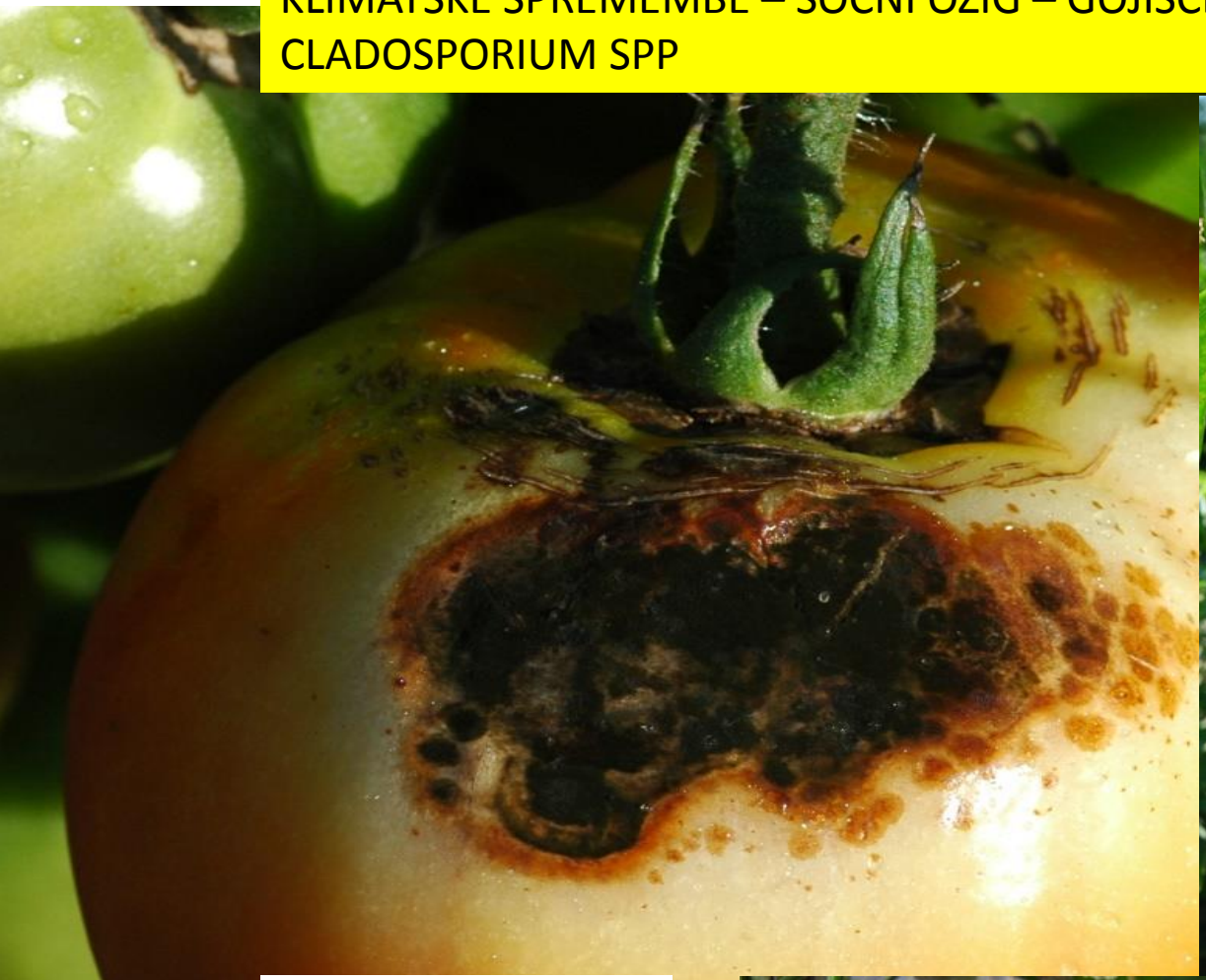


Fig. 1 Parasitic and saprophytic phases in the life cycle of *Stemphylium vesicarium* and *Pleospora allii* on pear orchards

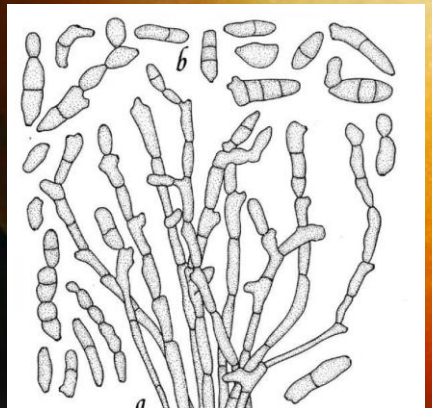


https://www.researchgate.net/publication/235916861_An_update_on_control_of_brown_spot_of_pear/figures?lo=1&utm_source=google&utm_medium=organic

KLIMATSKE SPREMEMBE – SOČNI OŽIG – GOJIŠČE ZA RAZVOJ GLIV / PRIMER CLADOSPORIUM SPP









https://extension.umn.edu/diseases/leaf-mold-tomato

https://www.tehnologijahrane.com/enciklopedija/etilen-i-ostali-biljni-hormoni-u-procesima-zrenja-i-dozrijevanja





Cladosporium herbarum

KLIMATSKE SPREMEMBE IN POZNE TRGATVE GROZDAJA – RECEPT ZA MIKOTOKSINE V VINU (AFLATOKSIN IN OHRATOKSIN)





S klimatskimi spremembami se spreminja tudi spekter gliv na grozdju pozno jeseni



RAZVOJ GLIV RODU ASPERGILLUS NA GROZDJU PRI OBIČAJNIH TRGATVAH V PRETKLOSTI NI BIL OMEMBE VREDEN POJAV – DANES JE TO SKORAJ REDEN POJAV







ŽAL ZELENA PLESEN NE PREIDE V ŽLAHNTNO PLESEN

Na voljo so številne objave

beverages

MDPI

Review

Wine Contamination with Ochratoxins: A Review

Jessica Gil-Serna [1,*], Covadonga Vázquez [1], María Teresa González-Jaén [2] and Belén Patiño [1]

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Abstract: Ochratoxin A (OTA) is the main mycotoxin occurring in wine. This review article is focused on the distribution of this toxin and its producing-fungi in grape berries, as well as on the fate of OTA during winemaking procedures. Due to its toxic properties, OTA levels in wine are regulated in different countries; therefore, it is necessary to apply control and detoxification methods that are also discussed in this revision.

Keywords: ochratoxins; wine; detoxification; grapes; legislation

Velika pogostost vzorcev vina, ki vsebujejo ohratoksin – posebej pozne trgatve

Table 1. Main studies regarding the worldwide occurrence of OTA in red, white and dessert wines. The results are indicated as the number of positive samples/total samples (percentage of positive samples) of each type of wine. The number of samples exceeding the EU legal limits (2 µg/L) as well as the percentage represented by these samples (between parentheses) are also indicated. The analysis methods used and the highest concentration detected are included.

COUNTRY	RED	WHITE	DESSERT	ANALYSIS METHOD	MAXIMUM OTA (µg/L)	SAMPLES ABOVE LIMITS	REFERENCE
Argentina	4/47 (9%)	-	-	HPLC	4.82	2 (4%)	[42]
Australia	49/344 (14%)	41/257 (16%)	3/13 (23%)	HPLC	0.62	0 (0%)	[43]
Canada	10/43 (23%)	5/36 (14%)	-	LC	0.39	0 (0%)	[44]
Chile	28/841 (3%)	6/313 (2%)	-	HPLC	0.35	0 (0%)	[45]
China	18/63 (29%)	4/42 (10%)	-	LC/MS	1.18	0 (0%)	[46]
	44/77 (57%)	1/34 (3%)	-		5.65	3 (3%)	[47]
Czech Republic	2/13 (15%)	3/33 (9%)	-	UPLC	0.07	0 (0%)	[48]
France	-	-	47/49 (96%)	LC/MS	1.22	0 (0%)	[49]
Greece	71/104 (68%)	63/118 (53%)	15/18 (83%)	HPLC	2.82	n.a.	[50]
	9/14 (65%)	7/13 (54%)	6/7 (86%)	HPLC	3.20	3 (9%)	[51]
	45/64 (70%)	31/49 (63%)	22/27 (81%)	HPLC	2.00	0 (0%)	[52]
Hungary	33/33 (100%)	31/32 (97%)	-	HPLC	0.53	0 (0%)	[53]
Italy	86/92 (93%)	-	9/15 (60%)	HPLC	3.86	n.a.	[54]
	695/1002 (69%)	125/204 (61%)	-	HPLC	2.63	29 (2%)	[55]
	37/38 (97%)	4/9 (57%)	-	HPLC	7.63	6 (13%)	[56]
	535/773 (69%)	128/290 (44%)	18/28 (64%)	HPLC	7.50	22 (2%)	[57]
	-	-	29/30 (97%)	HPLC	1.56	0 (0%)	[58]
Romania	17/44 (39%)	21/55 (38%)	-	HPLC	1.89	0 (0%)	[59]
Spain	24/130 (19%)	4/50 (8%)	-	HPLC	4.24	2 (1%)	[60]
	108/188 (57%)	4/6 (67%)	-	HPLC	0.18	0 (0%)	[61]
	-	-	32/40 (80%)	LC	0.64	0 (0%)	[62]
	-	-	186/188 (99%)	LC/MS	4.63	18 (1%)	[49]
South Africa	9/9 (100%)	15/15 (100%)	-	HPLC	0.39	0 (0%)	[63]
	19/65 (29%)	20/42 (48%)	11/15 (73%)	HPLC	2.67	n.a.	[64]
Turkey	44/51 (86%)	29/34 (85%)	-	HPLC	0.82	0 (0%)	[65]

(-) is indicated when the paper did not analyze this type of wine. n.a. = data not available in the original paper.

Review

Diversity of black Aspergilli and mycotoxin risks in grape, wine and dried vine fruits

STEFANIA SOMMA, GIANCARLO PERRONE and ANTONIO F. LOGRIECO

Institute of Sciences of Food Production, Research National Council, via Amendola 122/O, 70126 Bari, Italy

Summary. Mycotoxin risk in the grape product chain is primarily due to ochratoxin A (OTA) occurrence in wine and dried vine fruits. *Aspergillus carbonarius* and the *A. niger* group are the main agents of *Aspergillus* bunch rot of grape, and they, especially *A. carbonarius*, are responsible for OTA contamination worldwide. Fumonisin B_2 (FB_2) represents an additional potential mycotoxin risk in the grape-wine product chain and *A. niger*/*A. awamori* were recently reported as the FB_2 producers in grapes. A deeper understanding of the species diversity of black Aspergilli, together with specific knowledge of their ecology and epidemiology, can help to predict their occurrence. From this perspective several studies have been done regarding prevention and control of black Aspergilli and reduction of mycotoxin risk at all stages, from vineyard management to wine-making procedures. In this review a comprehensive overview of all these aspects is presented.

Key words: *Aspergillus* section *Nigri*, ochratoxin A, fumonisins, mycotoxin risk management.

Aspergillus black rot of grape

Aspergillus black rot is among one of the many bunch rots occurring on grapes. The disease appears on the berries as a black rot due to prolific fungal sporulation after it has invaded and consumed the berries which look completely empty and dry (Fig-

conditions that influence fungal population growth, interaction with the plants and mycotoxin production. This disease has received more attention since, in the last decade, it was associated with contamination of grapes and wine by ochratoxin A (OTA), a strong nephrotoxic compound which we will discuss thoroughly (Battilani *et al.*, 2003; Serra *et al.*, 2003;

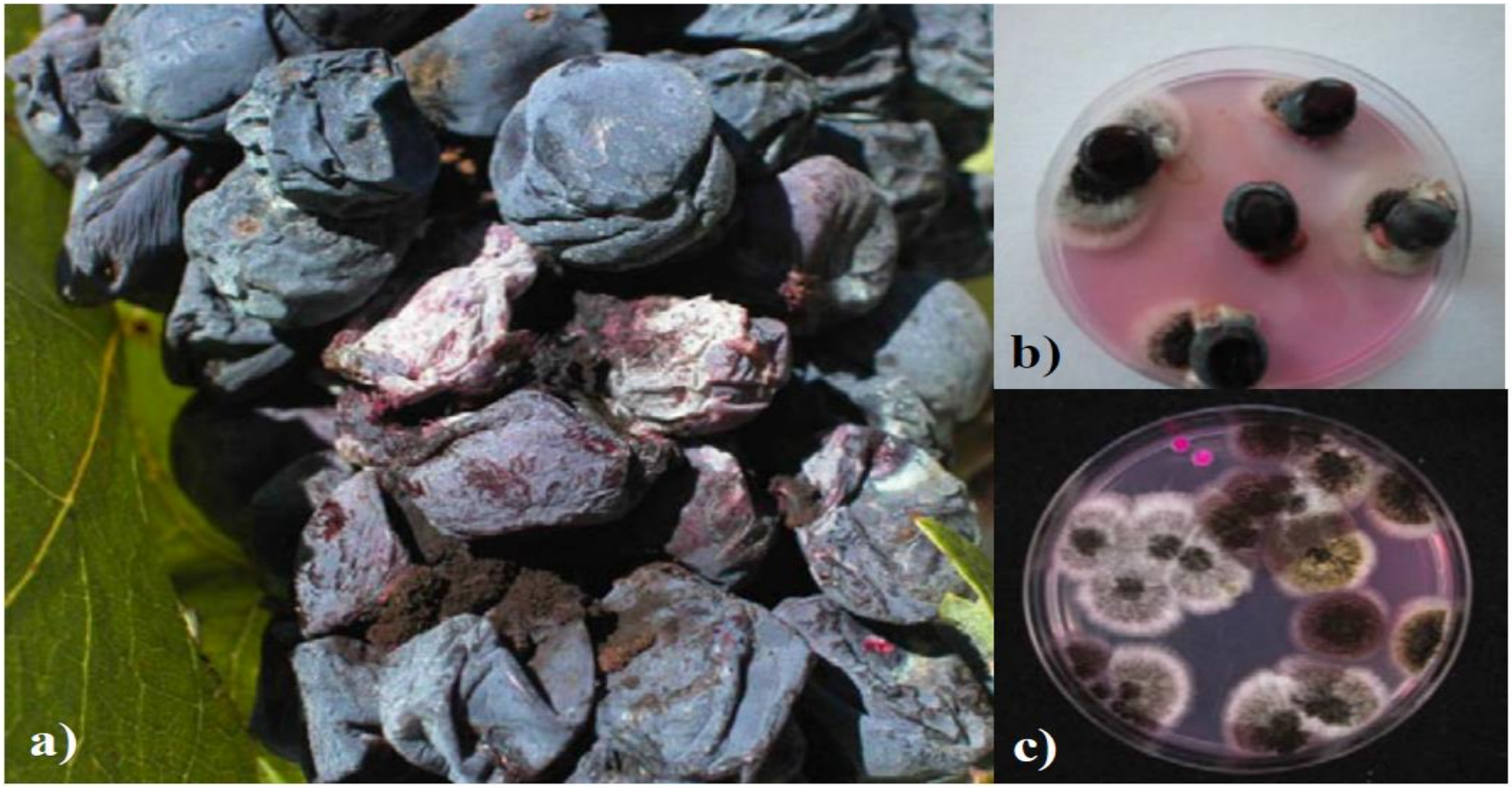


Figure 2. Black Aspergilli on grapes: a) black rot of berries caused by black Aspergilli; b) direct plating of berries on DRBC agar; c) different black *Aspergillus* colonies from berries' homogenate diluted and plated on DRBC.

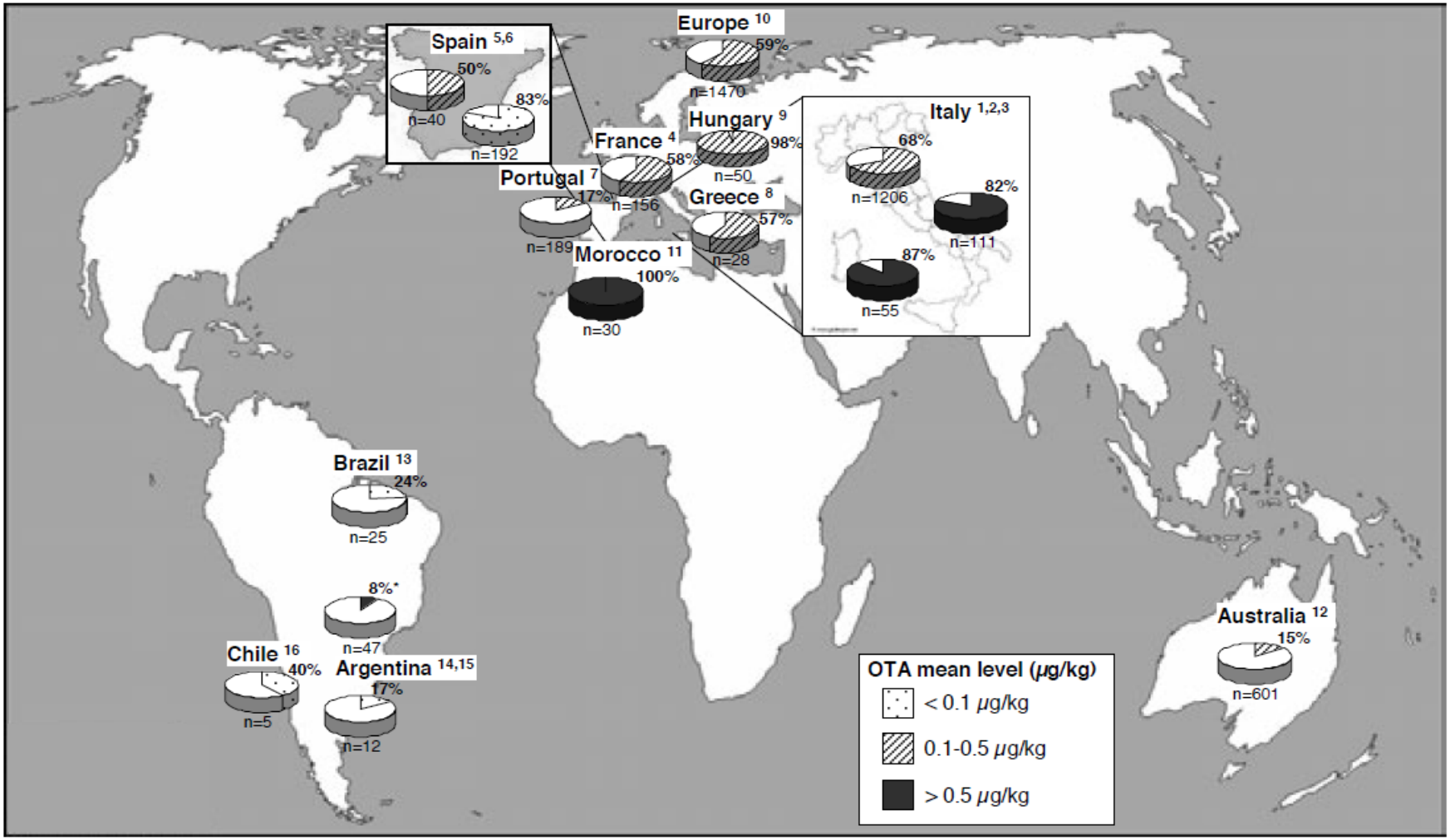


Figure 5. Ochratoxin A contamination of wine samples worldwide. Each graph shows the percentage of contamined samples on the total analyzed samples (number reported under the graph) and the mean level of ochratoxin A detected. The numbers near the country name indicate the literature references: [1] Spadaro *et al.*, 2010; [2] Pietri *et al.*, 2001; [3] Visconti *et al.*, 1999; [4] Clouvel *et al.*, 2008; [5] Lopez de Cerain *et al.*, 2002; [6] Burdaspal and Legarda, 1999; [7] Peito *et al.*, 2004; [8] Soufleros *et al.*, 2003; [9] Varga *et al.*, 2004; [10] Miraglia and Brera, 2002; [11] Zinedine *et al.*, 2010; [12] Hocking *et al.*, 2003; [13] Rosa *et al.*, 2004; [14] Ponsone *et al.*, 2010; [15] Rosa *et al.*, 2004; [16] Rosa *et al.*, 2004. * The OTA mean level is over 2.5 µg kg^{-1}.

NAMESTO BOTRITISNE ŽLAHTNE GNILOBE DOBIVAMO ASPERGILUSNO GNILOBO







ROZINE – OHRATOKSIN – TRADICIONALNE TEHNIKE SUŠENJA

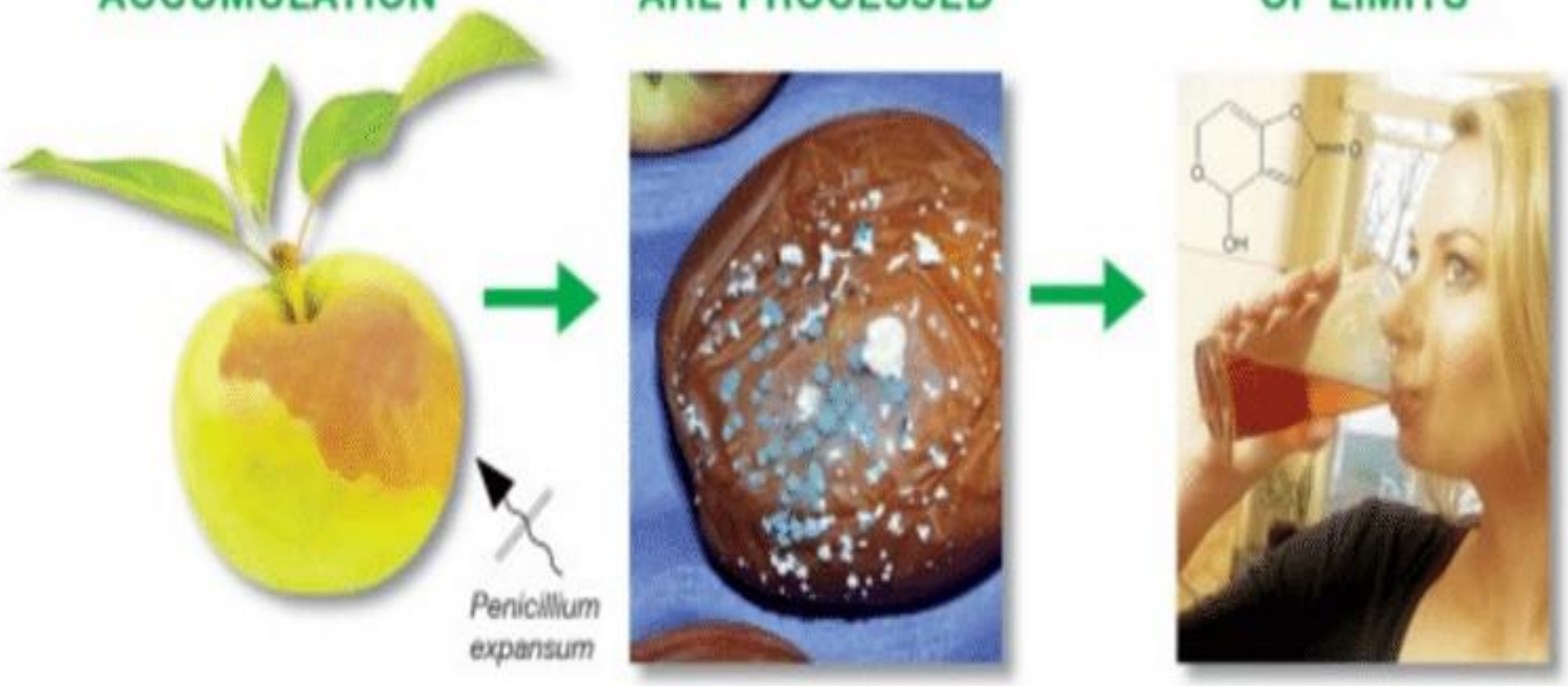
ROZINE so žal pomemben vir mikotoksinov







IZPOSTAVLJENOST PATULINU IN CITRININU V NEKATRIH PIJAČAH



Klimatske spremembe – povečana izpostavljenost patulinu – preveč ugodne razmere za razvoj gliv v času čakanja industrijskega sadja na procesiranje



Klimatske spremembe – povečana izpostavljenost patulinu – preveč ugodne razmere za razvoj gliv v času čakanja industrijskega sadja na procesiranje

Sadje za predelavo bi moralo na čakanju biti ohlajeno pa žal ni. Čaka na visoki temperaturi in glive se lahko pred procesiranjem zelo hitro razvijejo.



Na voljo veliko objav

toxins

MDPI

Review

Mitigation of Patulin in Fresh and Processed Foods and Beverages

J. David Ioi [1,2], Ting Zhou [1], Rong Tsao [1,*] and Massimo F. Marcone [2]

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Abstract: Patulin is a mycotoxin of food safety concern. It is produced by numerous species of fungi growing on fruits and vegetables. Exposure to the toxin is connected to issues neurological, immunological, and gastrointestinal in nature. Regulatory agencies worldwide have established maximum allowable levels of 50 μg/kg in foods. Despite regulations, surveys continue to find patulin in commercial food and beverage products, in some cases, to exceed the maximum limits. Patulin content in food can be mitigated throughout the food processing chain. Proper handling, storage, and transportation of food can limit fungal growth and patulin production. Common processing techniques including pasteurisation, filtration, and fermentation all have an effect on patulin content

ŽAL SEGERVANJE NA 90 DO 100 ^{O}C NE OMOGOČI POPOLNEGA RAZKROJA PATULINA

Table 2. Patulin degradation during heat treatment of liquid food products.

Processing Temperature (°C)	Processing Time (min)	Initial PAT (µg/kg)	PAT Reduction (%)	Reference
80	20	4	55	[86]
80	30	ND	NS	[87]
90	0.17	96.5	13.4	[80]
90	0.17	20	19	[88]
90	0.5	433	39.6	[81]
90	7	1500	60	[32]
90	10	140	12.1	[91]
90	20	220	18.8	[89]
90	20	1000	NS	[92]
100	20	220	26	[89]

NS = No significant reduction in patulin found; ND = No data available; PAT = patulin.

Table 1. Recent surveys of the occurrence of patulin in food commodities.

Food Commodity	Location	Range (μg/kg)	Positive (%)	Reference
Apples	Spain	0	0	[34]
Apples	Portugal	1–70.6	ND	[24]
Apples	United States of America	8.8–417.6	40.8	[35]
Figs	Turkey	39.3–151.6	ND	[23]
Tomatoes	Portugal	21.29	ND	[24]
Tomatoes	Belgium	ND	10.8	[25]
Bell Peppers	Belgium	ND	11.4	[25]
Hazelnuts	Turkey	16.6–92.4	ND	[36]
Cereal Based Foods	Portugal	0–4.5	75	[26]
Apple Juice	Italy	1.6–55.4	47	[37]
Apple Juice	Turkey	7–376	100	[38]
Apple Juice	Brazil	3–7	3	[39]
Apple Juice	Tunisia	2–889	64	[28]
Apple Juice	Portugal	1.2–42	41	[40]
Apple Juice	Belgium	2.5–39	81	[41]
Apple Juice	Spain	0–36.5	45	[42]
Apple Juice	South Korea	9.9–30.9	12.5	[43]
Apple Juice	Spain	2.5–6	7.1	[30]
Apple Juice	South Africa	5–45	24	[44]
Apple Juice	United States of America	8.8–2700.4	22.7	[35]
Apple Puree	Argentina	22–221	50	[22]
Apple Puree	Portugal	1.2–5.7	7	[40]
Apple Puree	Spain	0–50.3	13	[42]
Apple Puree	Italy	1.92	-	[45]
Apple Puree	South Africa	5–20	35	[44]
Apple Products	Argentina	17–39	16	[22]
Apple Products	China	1.2–94.7	12.6	[46]
Pear Products	Argentina	25	17	[22]
Pear Products	Italy	0.79	ND	[45]
Tomato Products	Italy	7.15	ND	[45]
Fruit Jam	Tunisia	2–554	20	[28]

PROIZVODNJA ŽGANIH PIJAČ IZ NEKVALITETNEGA SADJA - SLIVOVKA – OHRATOKSIN
OBSEŽNE POŠKODBE NA LEDVICAH - BALKANSKA NEFROPATIJA

www.healthvalue.net/Ochratoxin.html

Aflatoxin | Choose a MYCOTOXIN then click here

water damage | Harm from MYCOTOXINS click here

OCHRATOXIN

A/ SOURCES

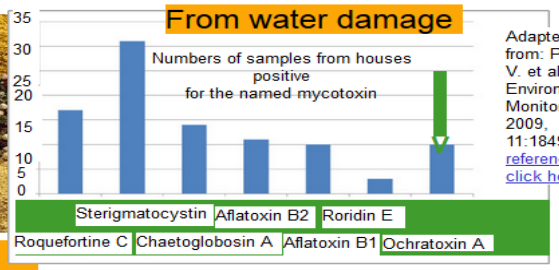


From food





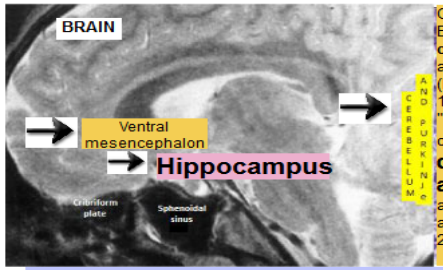
From water damage



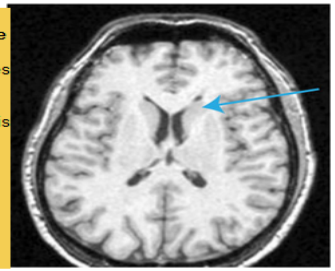
Adapted from: Polizzi V. et al., J. Environ. Monitoring. 2009, 11:1849 (full reference, click here)

B/ TARGETS

1/ BRAIN



Ochratoxin has a strong affinity for the Brain, especially **Cerebellum (Purkinje cells)** and **ventral mesencephalon**, and also for the **hippocampal** structures (Belmadani, Arch. Toxicol. 1999: 73: 108).
"OTA may contribute to the pathogenesis of **neurodegenerative diseases (e.g. Alzheimer's and Parkinson's disease)**", according to teams from Zhejiang Univ. and Kiel Univ.; Zhang et al., Genes Nutr. 2009, 4:41.



OTA causes acute depletion of striatal dopamine, which constitutes the bed of Parkinson's disease (Sava, 2006)

The hippocampus, a primary site of neurodegeneration in Alzheimer's disease, is affected by subchronic administration of OTA (Belmadani, Human Exp. Toxicol., 1998,17: 380)

After injection of a single OTA dose to mice (3 mg/Kg BW, IP) highest concentrations are found in the cerebellum (Zhang, 2009)

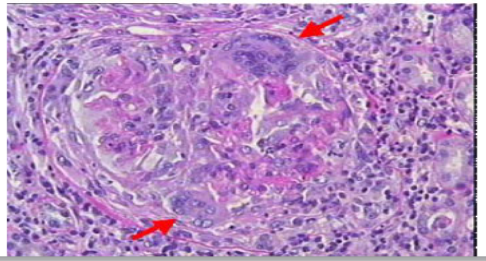
The developing brain is very susceptible to OTA, **hence risk in pregnancy** (Doi, 2011, Int. Journ. Mol. Sci, 12: 5213)

Breast feeding mothers must exert caution on their dietary intake: **ochratoxin in human breast milk** is not exceptional (Bhat, 2010)

2/ Kidney & urinary tract

OTA has been a prime suspect for BEN (Balkan Endemic Nephropathy) like for some cases of Focal Segmental Glomerulosclerosis, as well as for urinary tract tumors. Recent studies point more towards proximal tubule nephropathies, and a possible implication of the Wnt pathway.

Image of Focal Segmental Glomerulosclerosis



GLIVE RODU ALTERNARIA – MORDA NEKOLIKO PODCENJENE GLEDE POMENA GLEDE NA POVEČANO POGOSTOT POJAVLJANJA ZARADI KLIMATSKIH SPREMEMB



Hindawi
Journal of Food Quality
Volume 2017, Article ID 1569748, 20 pages
https://doi.org/10.1155/2017/1569748

WILEY | Hindawi

Review Article

Alternaria Mycotoxins in Food and Feed: An Overview

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Alternaria is one of the major mycotoxigenic fungal genera with more than 70 reported metabolites. *Alternaria* mycotoxins showed notably toxicity, such as mutagenicity, carcinogenicity, induction of DNA strand break, sphingolipid metabolism disruption, or inhibition of enzymes activity and photophosphorylation. This review reports on the toxicity, stability, metabolism, current analytical methods, and prevalence of *Alternaria* mycotoxins in food and feed through the most recent published research. Half of the publications were focused on fruits, vegetables, and derived products—mainly tomato and apples—while cereals and cereal by-products represented 38%. The most studied compounds were alternariol, alternariol methyl ether, tentoxin, and tenuazonic acid, but altenuene, altertoxins (I, II, and III), and macrosporin have been gaining importance in recent years. Solid-liquid extraction (50%) with acetonitrile or ethyl acetate was the most common extraction methodology, followed by QuEChERS and dilution-direct injection (both 14%). High- and ultraperformance liquid chromatography coupled with tandem mass spectrometry was the predominant determination technique (80%). The highest levels of alternariol and alternariol methyl ether were found in lentils, oilseeds, tomatoes, carrots, juices, wines, and cereals. Tenuazonic acid highest levels were detected in cereals followed by beer, while alternariol, alternariol methyl ether, tenuazonic acid, and tentoxin were found in legumes, nuts, and oilseeds.

World Mycotoxin Journal, May 2008; 1(2): 175-188

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Velika skupina toksinov z različnim karakterjem

Alternaria mycotoxins: an overview of chemical characterization, producers, toxicity, analysis and occurrence in foodstuffs

V. Ostry

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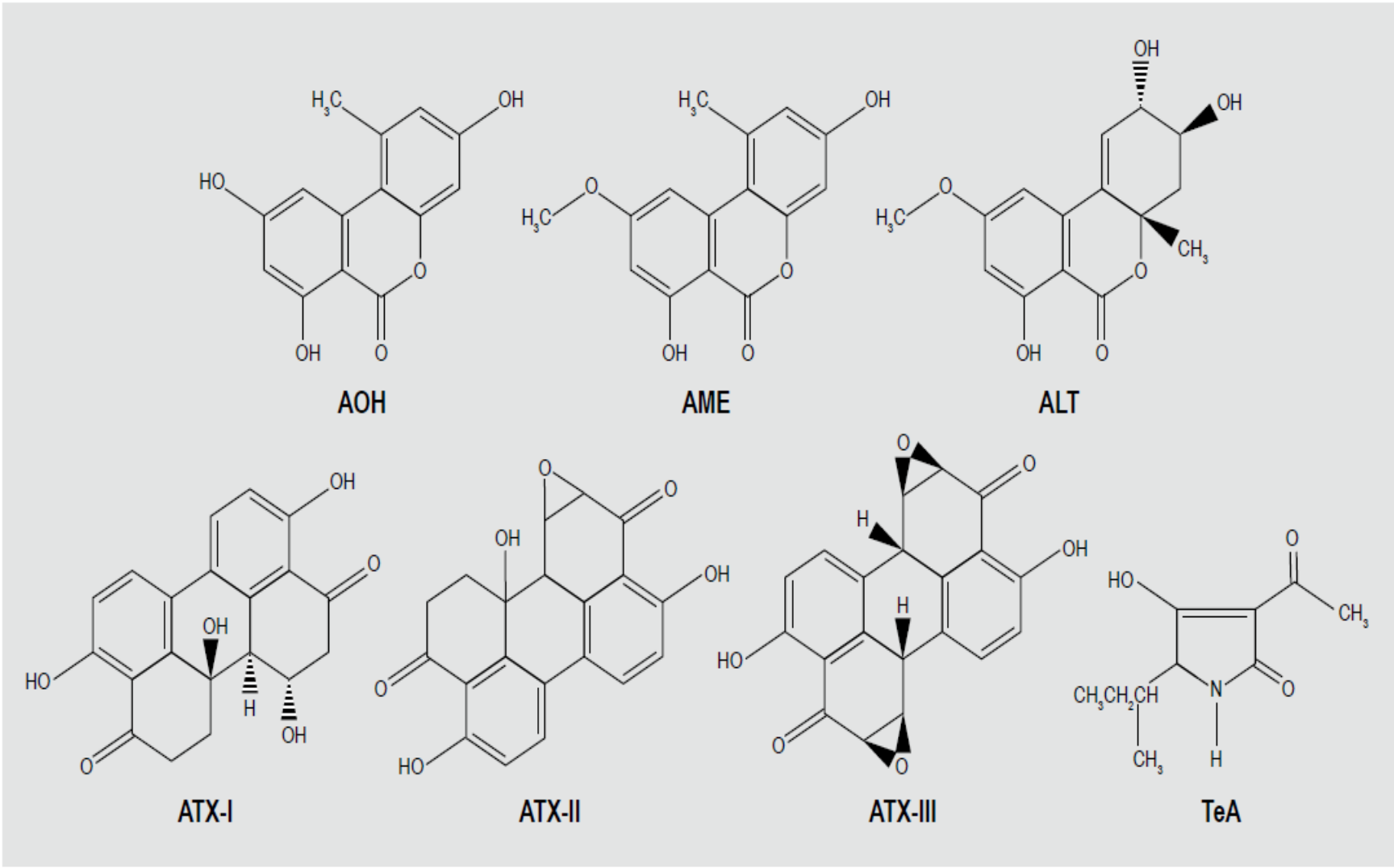


Figure 1. Chemical structure of AOH, AME, ALT, ATX-I, ATX-II, ATX-III and TeA.

Table 2. The production of important mycotoxins by *Alternaria* species (excluding *A. alternata*).

Species	Mycotoxin	Reference
A. brassicae (Berk.) Sacc.	AOH, AME	Bottalico and Logrieco, 1998
A. capsici-anui Săvul. & Sandu	AOH, AME, TeA	Bottalico and Logrieco, 1998
A. cassiae Jurair & A. Khan	ATX-I, -II	Hradil *et al.*, 1989
A. citri Ell. & Pierce	AOH, AME, TeA	Freeman, 1965; Kinoshita *et al.*,1972
A. cucumerina (Ell. & Ev.) Elliott	AOH, AME	Raistrick *et al.*,1953; Freeman, 1965
A. dauci (Kühn) Groves & Skolko	AOH, AME	Freeman, 1965; Raistrick *et al.*, 1953
A. japonica Yoshii	TeA	Kinoshita *et al.*, 1972
A. kikuchiana Tanaka	AOH, AME, TeA	Tirokata *et al.*, 1969; Kinoshita *et al.*, 1972; Kameda *et al.*, 1973
A. longipes (Ell. & Ev.)	AME, TeA	Mikami *et al.*, 1971; Bottalico and Logrieco, 1998
A. mali Roberts	ATX-I, -II, -III, TeA	Kinoshita *et al.*, 1972
A. oryzae Hara	TeA	Kinoshita *et al.*, 1972
A. porri (Ell.) Cif.	AME, TeA	Bottalico and Logrieco, 1998
A. radicina Meier, Drechsler & Eddy	ATX-I, -II, -III, TeA	Bottalico and Logrieco, 1998; Solfrizzo *et al.*, 2005
A. solani Sorauer	AOH, AME, TeA	Stoessl, 1969; Pollock *et al.*,1982; Bottalico and Logrieco, 1998
A. tenuissima (Kunze) Wiltshire	AOH, AME, ATX-I, -III, TeA	Davies *et al.*, 1977; Young *et al.*, 1980; Bottalico and Logrieco, 1998
A. tomato (Cooke) Jones	AOH, AME, ATX-I, -II, -III, TeA	Bottalico and Logrieco, 1998

Table 3. Overview of the natural occurrence of AOH, AME, ALT and TeA in foodstuffs (recent studies).

Country	Foods/ Foodstuffs	Year	Mycotoxin (µg/kg)	n[a]	n+%[b]	Mean (µg/kg)	Range (µg/kg)	LOD/LOQ (µg/kg)	References
Argentina	tomato puree	2006	AOH	80	6	141	187-8,756	5[c]	Terminiello *et al.*, 2006
			AME	80	26	157	84-1,734	2[c]	
			TeA	80	29	227	29-4,021	11[c]	
Czech Republic	tomato puree	2006	AOH	10	100	7.9	1.2-14.1	0.08	J. Hajslova (personal communications)
			AME	10	100	1.3	1.2-2.7	0.05	
			ALT	10	10	0.4	N[d]	0.27	
Czech Republic	peeled tomato	2006	AOH	5	100	1.2	0.5-1.9	0.08	
			AME	5	100	0.2	0.2-0.3	0.05	
			ALT	5	0	-	-	0.27	
Czech Republic	tomato juice	2006	AOH	2	100	0.4	0.1-0.7	0.08	
			AME	2	50	0.8	N[d]	0.05	
			ALT	2	0	-	-	0.27	
Czech Republic	tomato ketchup	2004	AOH	8	100	6.9	0.3-27.4	0.08	
			AME	8	100	1.6	0.2-5.8	0.05	
			ALT	8	12.5	1.2	N[d]	0.27	
Czech Republic	tomato ketchup	2006	AOH	21	81	1.0	0.1-3.7	0.08	
			AME	21	100	0.4	0.06-1.2	0.05	
			ALT	21	0	-	-	0.27	
Canada	red wine (home)	2006	AOH	17	76	0.98	0.03-5.02	0.01	Scott *et al.*, 2006
			AME	17	76	0.09	0.01-0.23	0.01	
	red wine import	2006	AOH	7	100	4.7	0.27-19.4	0.01	
			AME	7	26	0.06	0.01-0.19	0.01	
Canada	ice-wine (home)	2007	TeA	26	0	-	-	70	Abramson *et al.*, 2007
Czech Republic	wine (home)	2004	AOH	39	0	-	-	1.5[c]	Ostry *et al.*, 2007
	grape juice, must		AME	39	0	-	-	1.5[c]	
			ALT	39	0	-	-	1.5[c]	
			TeA	39	0	-	-	7.5[c]	
Germany	edible oils	2007	AOH	38	N[d]	N[d]	max 15	0.07	Kocher, 2006, 2007
			AME	38	N[d]	N[d]	max. 85	0.05	
			ALT	38	0	-	-	0.25	
			ATX-I	38	0	-	-	0.05	

POMEMBNO VPRAŠANJE VODOTOPNOSTI ALTERNARIJSKIH MIKOTOKSINOV V VODI IN HITROST POTOVANJA PO RASTLINSKIH TKIVIH

Table 1. Typical mycotxoins investigated in herbal medicines.

Type of Mycotoxin	Source and Solubility	References	
		Source	Solubility
Aflatoxin (AFB_1, AFB_2, AFG_1, AFG_2, AFM_1)	**Main source:** *Aspergillus* **Solubility:** soluble in moderately polar organic solvents (e.g., chloroform, methanol, dimethysulfoxide), scarcely soluble in water (10–30 mg/mL) and insoluble in non-polar organic solvents	[16–18]	[18]
Ochratoxins (OTA, OTB)	**Main source:** *Aspergillus* and *Penicillium* **Solubility:** OTA: moderately soluble in polar organic solvents (e.g., chloroform, methanol) and dissolves in dilute aqueous sodium bicarbonate	[16–18]	[18]
Trichothecenes (Type A trichothecenes: (T-2, HT-2, NEO, DAS), Type B trichothecenes (DON, NIV, DOM-1, Fusarenone-X))	**Main source:** *Fusarium*, *Myrothecium*, *Stachybotrys*, *Trichoderma*, *Cephalosporium*, *Trichothecium* and *Verticimonosporium* **Solubility:** Type A trichothecenes: highly soluble in ethyl acetate, acetone, chloroform, dichloromethane and diethyl ether; Type B trichothecenes: soluble in methanol, acetonitrile and ethanol	[18,19]	[18]
Zearalenones (ZEN, α-ZOL, β-ZOL, ZAN)	**Main source:** *Fusarium* **Solubility:** ZEN: soluble in water, slightly soluble in hexane and progressively more soluble in benzene, acetonitrile, dichloromethane, methanol, ethanol and acetone	[16,18]	[18]
Fumonisins (FB_1, FB_2, FB_3)	**Main source:** *Fusarium* **Solubility:** soluble in water, acetonitrile–water or methanol, and insoluble in chloroform and hexane	[16–18]	[18]
Alternaria toxins (AOH, AME, TEA, TEN)	**Main source:** *Alternaria* **Solubility:** AME: insoluble in aqueous $NaHCO_3$ or water, slightly soluble in ether, sparingly soluble in benzene AOH: insoluble in hexane, light petroleum, benzene, aqueous $NaHCO_3$ and water, more soluble than AME in ethanol, methanol, acetone TEA: slightly soluble in water TEN: slightly soluble in benzene	[10,20]	[21]
Patulin	**Main source:** *Penicillium* **Solubility:** soluble in water, methanol, ethanol, acetone and ethyl or amyl acetate and less soluble in diethyl ether and benzene	[18]	[18]
Citrinin	**Main source:** *Aspergillus*, *Penicillium* and related species **Solubility:** practically insoluble in water, soluble in ethanol, dioxane, dilute alkali, acetone, benzene, and chloroform	[18]	[22]
Cyclopiazonic acid	**Main source:** *Penicillium* and other fungi species including *Aspergillus* **Solubility:** soluble in chloroform and dimethyl sulfoxide	[18]	[18]
Sterigmatocystin	**Main source:** *Aspergillus* **Solubility:** highly soluble in pyridine	[18]	[23]

ALTERNARIJSKI MIKOTOKSINI - PROCESIRANJE PARADIŽNIKA SLABŠE KAKOVOSTI

- INDUSTRIJA SOKA, MEZGE IN KETCHUPA
- TRADICIONALNA PRIPRAVA NEKATERIH IZDELKOV DOMA V GOSPODINSTVU

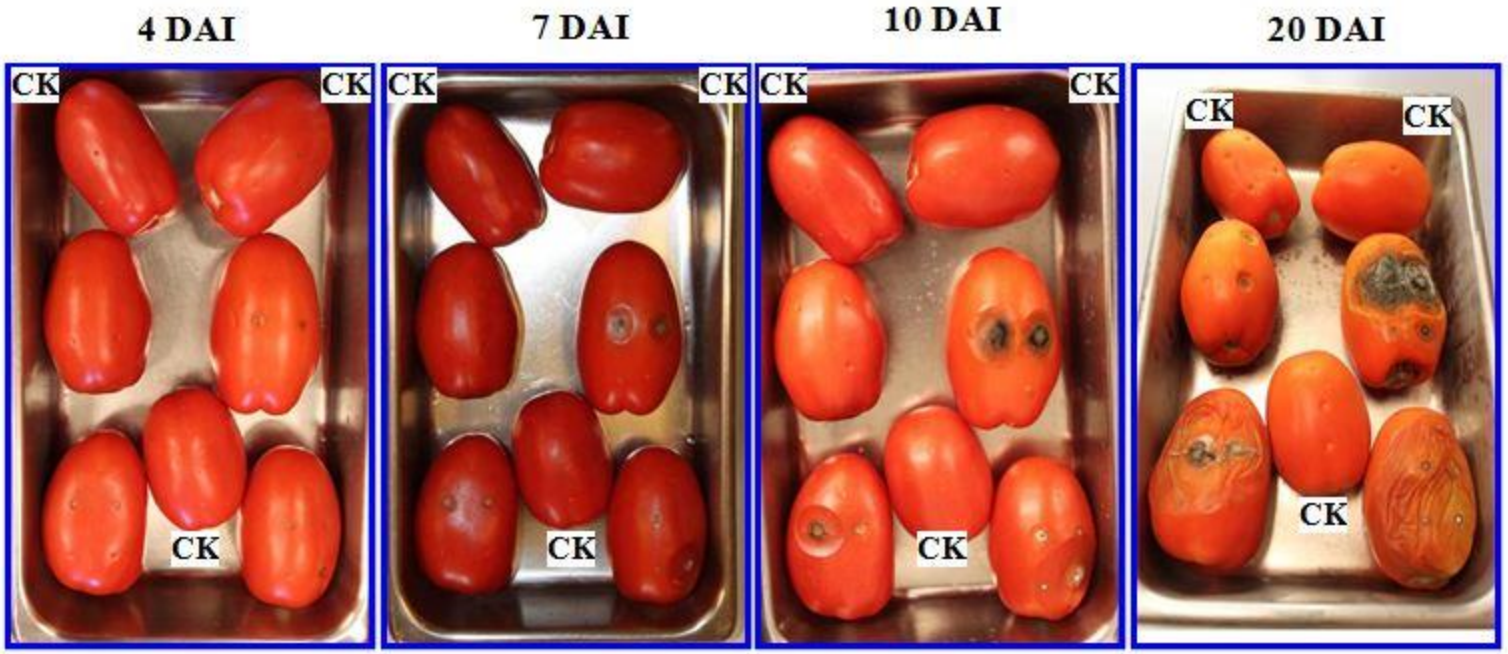


PROBLEM EKOLOŠKIH SORT KI RADE POKAJO V OBMOČJU PECLJA

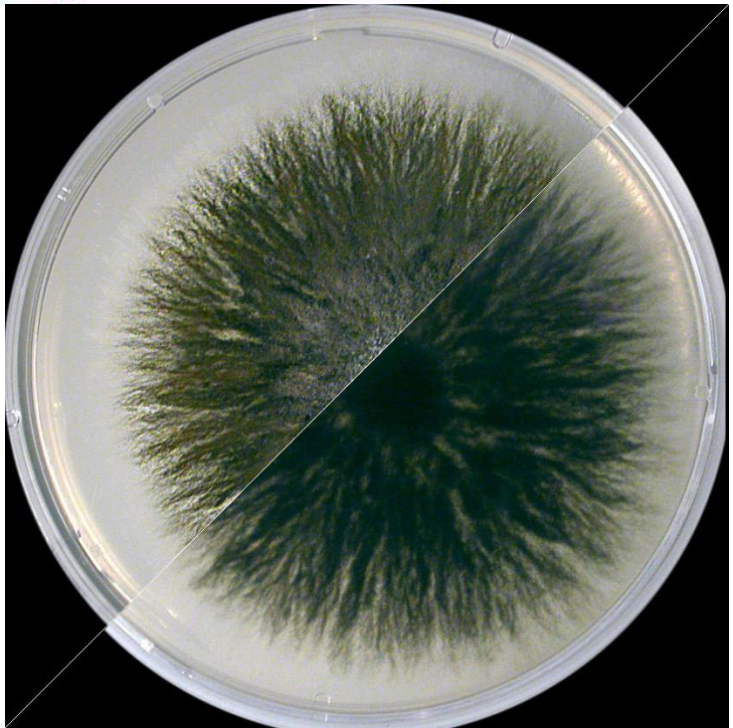


PRI PARADIŽNIKU V DRUGEM DELU SEZONE POGOSTO UPORABLJAMO PLODOVE, KI IZVIRAJO IZ RASTLIN, KI SO MOČNO NAPADENE OD ALTERNARIJE
POGOSTO JE TUDI DO-DOZOREVANJE ZELENIH POTRGANIH PARADIŽNIKOV / EKO PRIDELAVA




4 DAI
7 DAI
10 DAI
20 DAI
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Primer članka ki obravnava pojav alternarijskih mikotoksinov v izdelkih iz paradižnika

Santos et al., Enz Eng 2016, 5:3
DOI: 10.4172/2329-6674.1000156

Enzyme Engineering

ISSN: 2329-6674

Research Article

OMICS International

Quality and Occurrence of Mycotoxins in Tomato Products in the Brazilian Market

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[2]*Embrapa, Parque Estação Biológica, s/n, 70770-901, Brasilia, DF, Brazil*

Abstract

The study aimed at evaluating physical, chemical and microbiological quality of tomato products and to investigate the occurrence of *Alternaria alternata* mycotoxins in tomato pulp, extract and ketchup. Tomato products were evaluated for physical and chemical characteristics, as well as for the occurrence of foreign matter, quality of raw material (using the Howard mold count - HMC), and adequacy of microbiological parameters to the current Brazilian legislation. *A. alternata* mycotoxins alternariol (AOH) and alternariol monomethyl ether (AME) were quantified using High Performance Liquid Chromatography with Diode-Array Detection (HPLC-DAD). Mycotoxin contamination was observed in one tomato brand commercialized in Brazil. Pulp sample from brand A presented soluble solids contents lower than 6%. Only tomato extract brand B showed no foreign material. Mycotoxins were not found in pulp and tomato paste in all brands. AOH levels ranging from 1.22 to 8.45 µg/g were found in brand A ketchup samples. Mycotoxin AME was identified in brand C ketchup. All products showed differences in physical and chemical characteristics but within the parameters described in current legislation. Regarding microbiological quality, all brands and products (paste, pulp and ketchup) are also in accordance with the legislation. Insect fragments, mites and rodent hair were identified in almost all brands and products, within acceptable limits. AOH and AME mycotoxins produced by *Alternaria alternata* were identified only in ketchups.

V GOSPODINSTVU SE VEČKRAT IZDELUJEJO PRODUKTI, KI LAHKO IMAJO POVEČANE VSEBNOSTI ALTERNARIJSKIH MIKOTOKSINOV ČE PROCESIRAMO OD ALTERNARIJE OKUŽENE PARADIŽNIKE – PRAKSA ODREZOVANJA MALO NAPADENIH DELOV



Fotografije SIMBOLIČNE spletni viri SLO









„SRBSKA SOLATA“ – PRECEJ TARDICIONALEN DOMAČ PROIZVOD, KI SE POGOSTO NAREDI IZ NEZRELIH PARADIŽNIKOV IN PAPRIK, KI SO JESENI OSTALI NA RASTLINAH PROPADAJOČIH OD SLABEGA VREMENA IN OD MONOŽIČNIH ALTERNARIJSKIH OKUŽB

- STANJE GLEDE MIKOTOSKINOV JE POPOLNOMA NEZNANO – REAKCIJA S KISLIM MEDIJEM NI POVSEM PREUČENA

Fotografije simbolične spletni viri SLO





RAZVOJ ALTERNARIJSKIH GLIV V TOPLIH GREDAH - MILE ZIME

Fotogarfije toplih gred simbolične spletni viri SLO

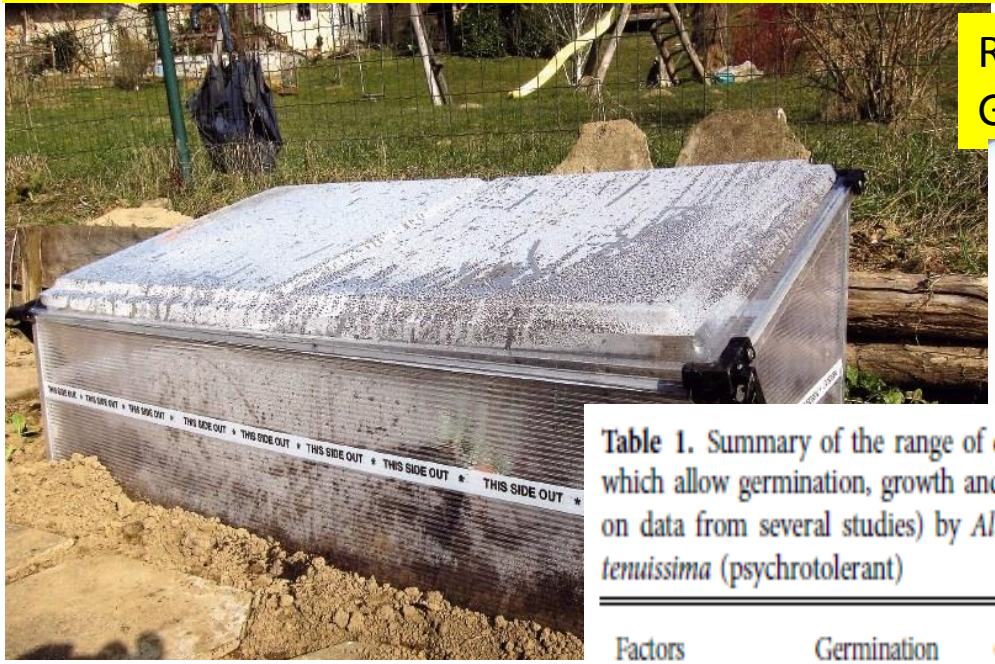








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RAZVOJ ALTERNARIJSKIH GLIV V TOPLIH GREDAH MILE ZIME

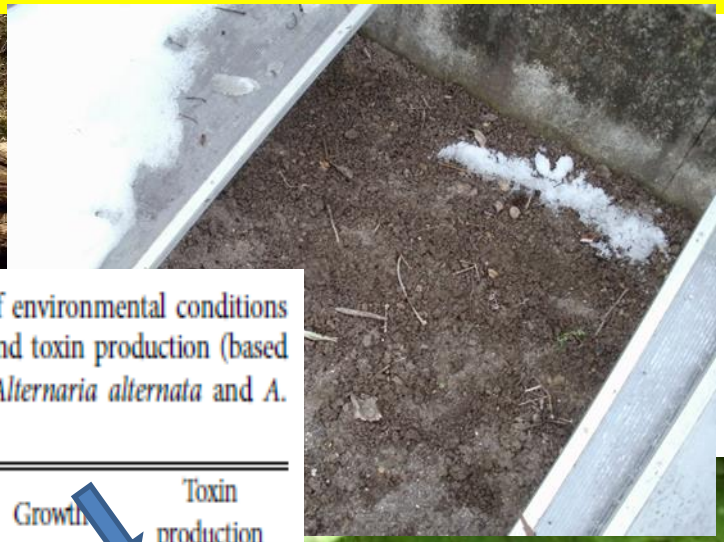
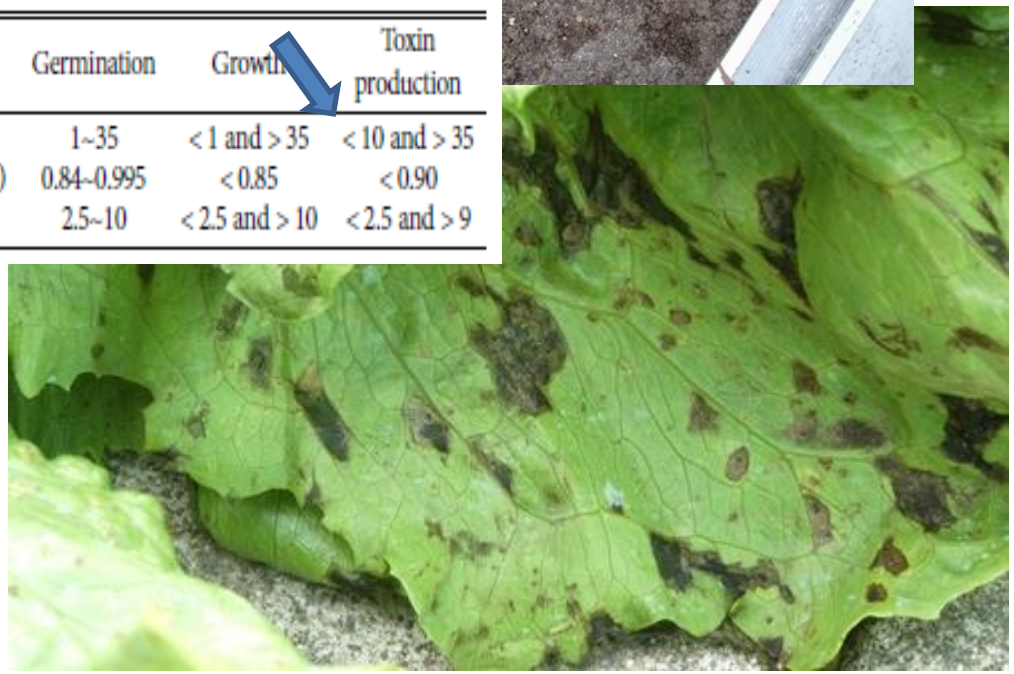


Table 1. Summary of the range of environmental conditions which allow germination, growth and toxin production (based on data from several studies) by *Alternaria alternata* and *A. tenuissima* (psychrotolerant)

Factors	Germination	Growth	Toxin production
Temperature (°C)	1~35	< 1 and > 35	< 10 and > 35
Water activity (a_w)	0.84~0.995	< 0.85	< 0.90
pH	2.5~10	< 2.5 and > 10	< 2.5 and > 9





NEUSTREZNO SKLADIŠČENJE KORENOVK
RAZVOJ ALTERNARIJE V SKLADIŠČU







Comparison of *Alternaria* spp. Collected in Italy from Apple with *A. mali* and Other AM-Toxin Producing Strains

F. Rotondo, M. Collina, A. Brunelli, and B. M. Pryor

First, second, and third authors: *Alma Mater Studiorum* University of Bologna, Department of Agri-food Protection and Improvement (Diproval), Viale Fanin, 46 Bologna, Italy; and first and fourth authors: University of Arizona, Department of Plant Sciences, P.O. Box 210036, Tucson.

Accepted for publication 20 August 2012.

ABSTRACT

Rotondo, F., Collina, M., Brunelli, A., and Pryor, B. M. 2012. Comparison of *Alternaria* spp. collected in Italy from apple with *A. mali* and other AM-toxin producing strains. Phytopathology 102:1130-1142.

Since 1999, a disease of apple caused by an *Alternaria* sp. has been affecting orchards in northern Italy resulting in necrotic spots on leaves and on fruit. Forty-four single-spored isolates were obtained from diseased plant materials to investigate the diversity of this fungus in Italy and to compare these isolates to isolates of *Alternaria* associated with apple disease in previous studies, including *A. mali*, causal agent of apple blotch. All isolates, including the reference strains, were tested for pathogenicity utilizing in vitro bioassays on detached leaf or on fruit ('Golden Delicious'). In addition, morphological characterizations were conducted describing both the three-dimensional sporulation pattern and the colony morphology of each isolate. In order to assess the genetic diversity within the Italian *Alternaria* population, sequence characterization of specific loci and anonymous regions (endoPG, OPA1-3, OPA2-1, and OPA10-2) and genetic fingerprinting based on amplified fragment length polymorphism and inter simple sequence repeat markers were performed. The single spore isolates exhibited differential pathogenicity, which did not correlate with the morphological groupings or to groupings defined by molecular approaches. Moreover, 10 pathogenic isolates out of the 44 single-spored tested were positive for the host-specific AM-toxin gene based upon polymerase chain reaction amplification using specific primers for the AM-toxin gene. This suggests that the production of the AM-toxin may be involved in pathogenesis by some of the Italian isolates of *A. alternata* from apple. However, this research also suggests that a number of different *Alternaria* genotypes and morphotypes may be responsible for the apple disease in Italy and that a single taxon cannot be defined as the sole causal agent.

ALTERNARIA MALI - ALTERNARIJSKA ANTRAKNOZA LISTJA JABLANE







ALTERNARIA MALI - novejša bolezen v nasadih jabłan

ALTERNARIA MALI - novejša bolezen v nasadih jablan



ALTERNARIA MALI - MOŽNOST PREHAJANJA MIKOTOKSINOV IZ LISTJA V PLODOVE ????




ALTERNARIA MALI

Alternaria mali – EKO JABOLKA



KAJ LAHKO NAREDIMO V NEPOSREDNEM VARSTVU RASTLIN ???

FUZARIOZE ŽIT IN KORUZE

ŠTEVILNI EU PROJEKTI ZA IZDELAVO PRIPOROČIL



Summary

Fusarium ear blight (*Fusarium* spp.) is seen as an increasing problem in many parts of Europe. The disease is of major concern due to the production of mycotoxins by the fungi involved. It is a disease which is highly linked to crop rotation and tillage methods. The risk is particularly high in regions where maize is a widely grown crop in the rotation and reduced or minimum tillage is practiced.

Genetic resistance is available with effective levels of control available in some cultivars. Application of good agricultural practices can help significantly to keep the disease and mycotoxin levels low. In seasons with high rainfall levels during flowering combined with high risk situations (normally maize and minimal tillage) specific fungicide programmes need to be applied during flowering.

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About ENDURE

ENDURE is the European Network for the Durable Exploitation of Crop Protection Strategies. ENDURE is a Network of Excellence (NoE) with two key objectives: restructuring European research and development on the use of plant protection products, and establishing ENDURE as a world leader in the development and implementation of sustainable pest control strategies through:

- Building a lasting crop protection research community
- Providing end-users with a broader range of short-term solutions
- Developing a holistic approach to sustainable pest management
- Taking stock of and informing plant protection policy changes.

Eighteen organisations in 10 European countries are committed to ENDURE for four years (2007-2010), with financial support from the European Commission's Sixth Framework Programme, priority 5: Food Quality and Security.

Website and ENDURE Information Centre

www.endure-network.eu

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From Science to Field
Wheat Case Study – Guide Number 2

Strategies to Control *Fusarium* Ear Blight and Mycotoxin Production in Wheat

Bill Clark, Rothamsted Research, UK
Lise Nistrup Jørgensen, Aarhus University, Denmark
Daniele Antichi, SSSUP, Italy
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endure
diversifying crop protection

Food Quality and Safety
SIXTH FRAMEWORK PROGRAMME

DON risk assessment grid on wheat ARVALIS-Institut du végétal 2008

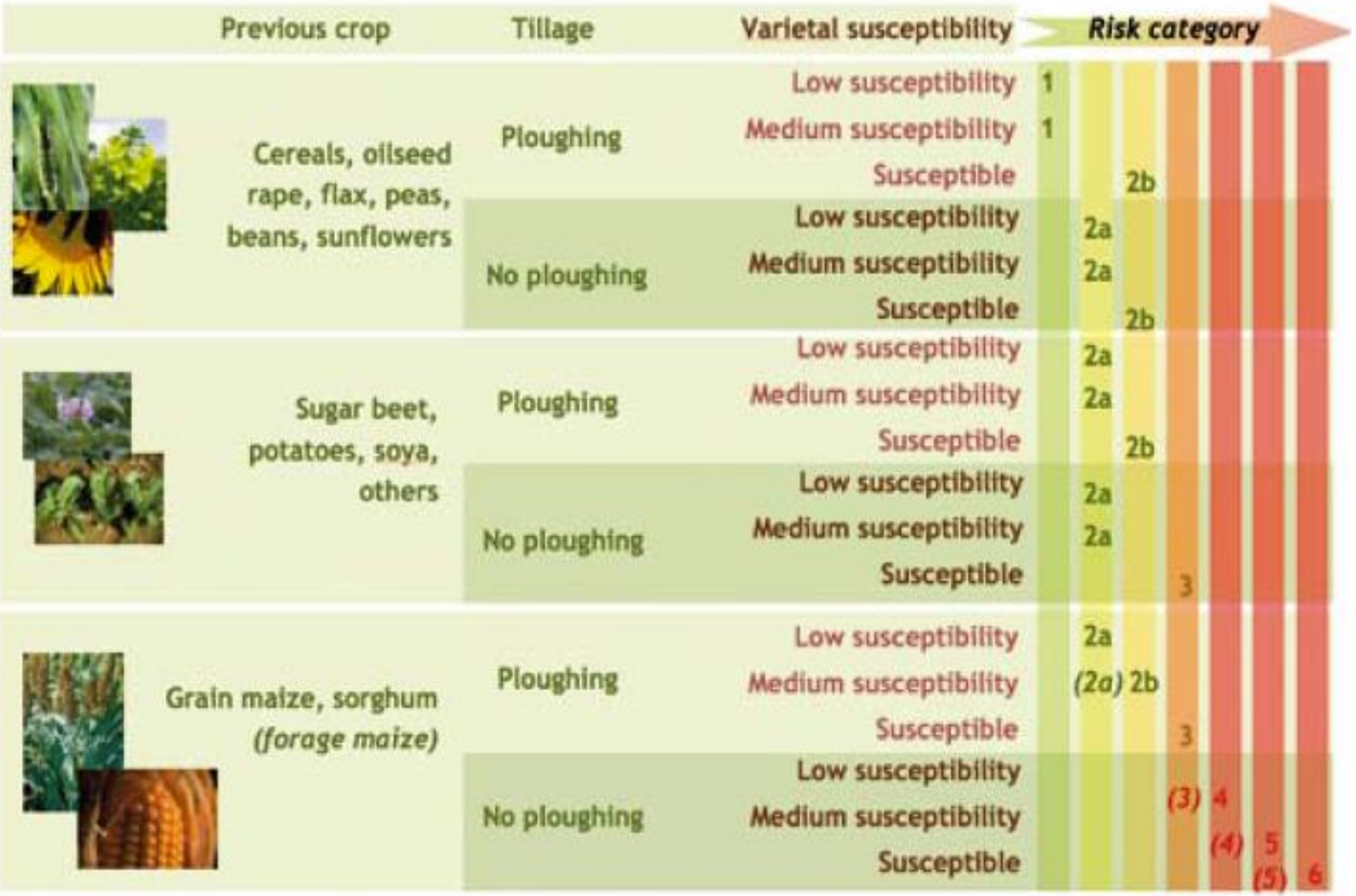
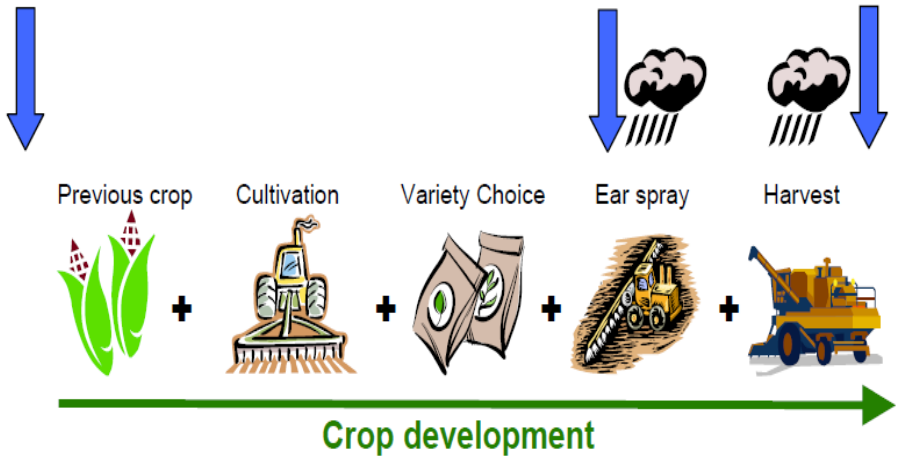


Figure 4: Decision key for DON risk (Source: Arvalis, France)

3.2. Key Risk Factors

The table below summarises the key risk factors that contribute to the occurrence of fusarium mycotoxins in cereal crops, providing growers with an indication of the overall risk to their crops (please refer to the following full text for further details).

Assessment of Risk =	HIGH	MEDIUM	LOW
Region	South and East England	West England, Wales and Northern Ireland	North England and Scotland
Previous Crop	Maize	Wheat	Other Crop
Crop Residue Management	No Crop Debris Removal or Burial	Min-Till	Ploughing
Variety Choice		Low Ear Blight Resistance	High Ear Blight Resistance
Weather Conditions	Heavy Rain during Flowering	Slight Rain during Flowering	No Rain during Flowering
Fungicide Use		No Ear Blight Fungicide Used	Ear Blight Fungicide Used
Lodging		Crop Lodged	Crop Not Lodged
Harvest		Wet Harvest Conditions	Dry Harvest Conditions



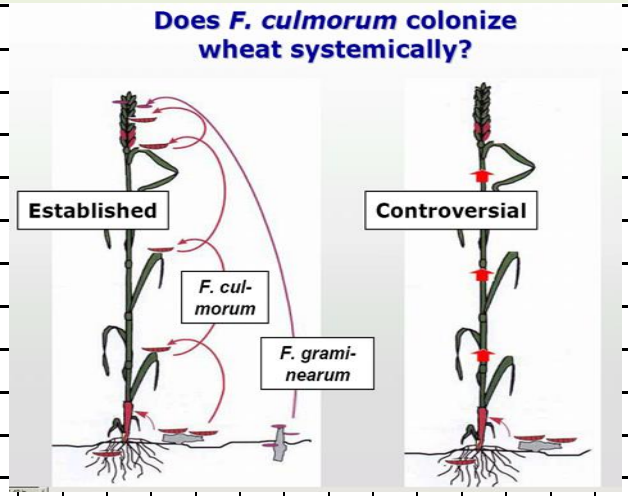
2.1.1. Best practices



2.1.2. Worst case scenario



Fuzarioze žit - relativni pomen varstvo proti ostalim dejavnikom (STANJE NA NJIVI)



V	Vreme
S	Sortne lastnosti
O	Obdelava tal
FFS1	Izbor pripravkov
FFS2	Termin uporabe pripravkov in zaporedje
K	Kolobar
T	Tip tal
GN	Gnojenje in gostota sestoja – poleganje
PŽ	Manipulacija požetvenih ostankov
ŠK	Zatiranje škodljivcev
SPR	TERMIN IN NAČIN SPRAVILA

MED VRSTAMI F. CULMORUM, F. GRAMINEARUM, F. POAE, F. AVENACEUM LAHKO OBSTAJAJO RAZLIKE GLEDE POMENA DEJAVNIKOV GLEDE NA NAČIN OKUŽEVANJA (CVET / KORENINE) IN VREMENSKE RAZMERE KI SO ZANJE UGODNE

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Food Quality and Safety
6TH FRAMEWORK PROGRAMME

Fuzarioza koruze

From Science to Field
Maize Case Study – Guide Number 3

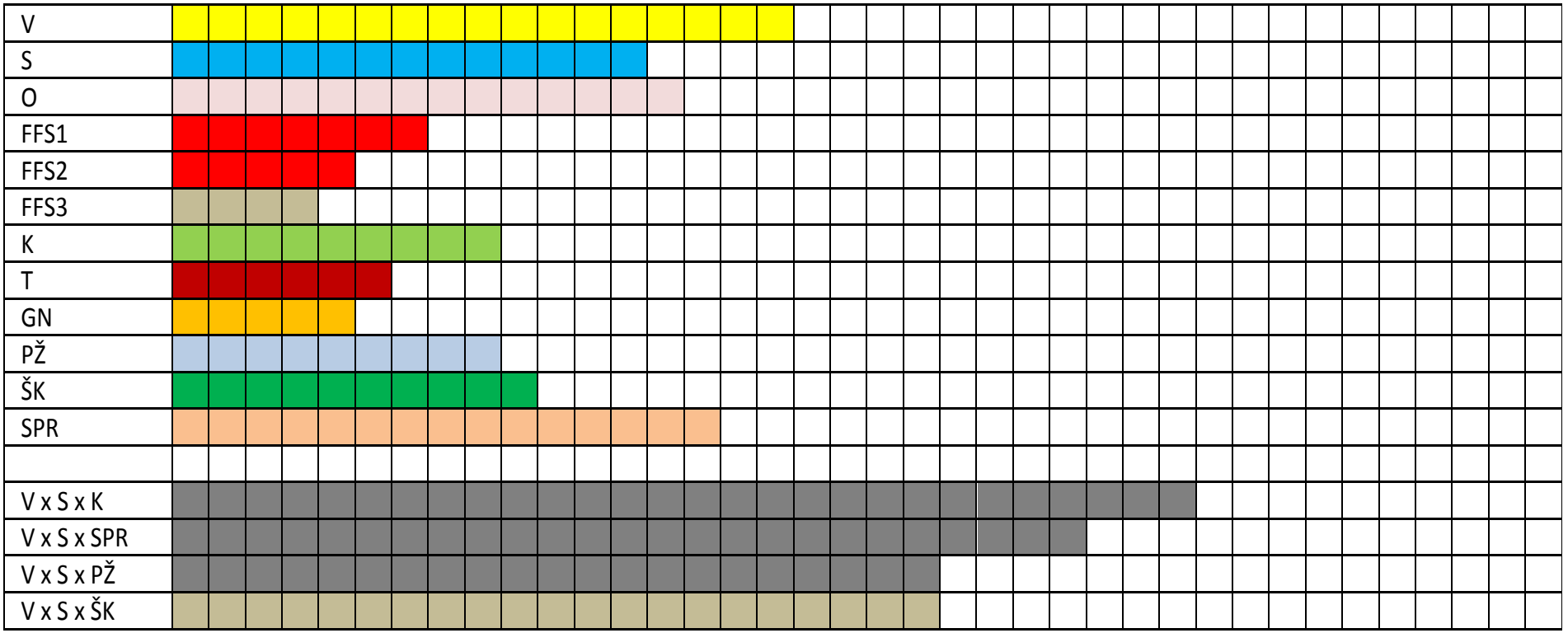
Prevention Of Ear Rots Due To *Fusarium* Spp. On Maize And Mycotoxin Accumulation

Elzbieta Czembor, Plant Breeding and Acclimatization Institute, Radzikow, Poland; Jozef Adamczyk, Plant Breeding Smolice Ltd., Kobylin, Poland; Katalin Posta, Plant Protection Institute, Szent István University, Gödöllö, Hungary; Elisabeth Oldenburg, Julius Kühn Institute, Braunschweig, Germany; Stephanie Schürch, Agroscope ACW Changins-Wädenswil, Switzerland

Table 2: Tentative ranking of management options and their impact on ear rot diseases

Management factors	Impact on ear rot reduction
Preventive control	
Crop rotation	High
Crop residue management	High
Harvest time and storage	High
Good nutrient supply	Medium
Varietal choice	Medium
Seed quality	Low
Sowing time	Low
Crop structure	Low
Direct control	
Insect control	High
Weed control	Low
Chemical disease control	Low

Fuzarioze koruze - RELATIVNI POMEN varstvo proti ostalim dejavnikom (STANJE NA NJIVI)



V	Vreme
S	Lastnosti HIBRIDOV
O	Obdelava tal
FFS1	Izbor pripravkov – INSEKTICID
FFS2	Izbor pripravkov – FUNGICIDI
FFS3	Termin uporabe pripravkov in zaporedje
K	Kolobar
T	Tip tal
GN	Gnojenje in gostota sestoja – poleganje
PŽ	Manipulacija požetvenih ostankov
ŠK	Zatiranje škodljivcev
SPR	TERMIN IN NAČIN SPRAVILA

MED VRSTAMI
F. CULMORUM,
F. GRAMINEARUM, F. POAE, F. AVENACEUM
LAHKO OBSTAJAJO RAZLIKE GLEDE POMENA DEJAVNIKOV
GLEDE NA NAČIN OKUŽEVANJA (CVET / KORENINE) IN VREMENSKE RAZMERE KI SO ZANJE UGODNE

Okužbe v začetku razvoja – sistemi konzervirajoče obdelave in no-till obdelave
POVEČANE TEŽAVE V ZAČETNEM PREHODNEM OBDOBJU
EKVILIBRIJ MED PATOGENI IN SAPROFOTI PO PREHODNEM OBDOBJU
VELIKA AKTIVNOST MNOŽICE SAPROFITOV ZNAČILNO OMEJI RAZVOJ FUZARIJEV

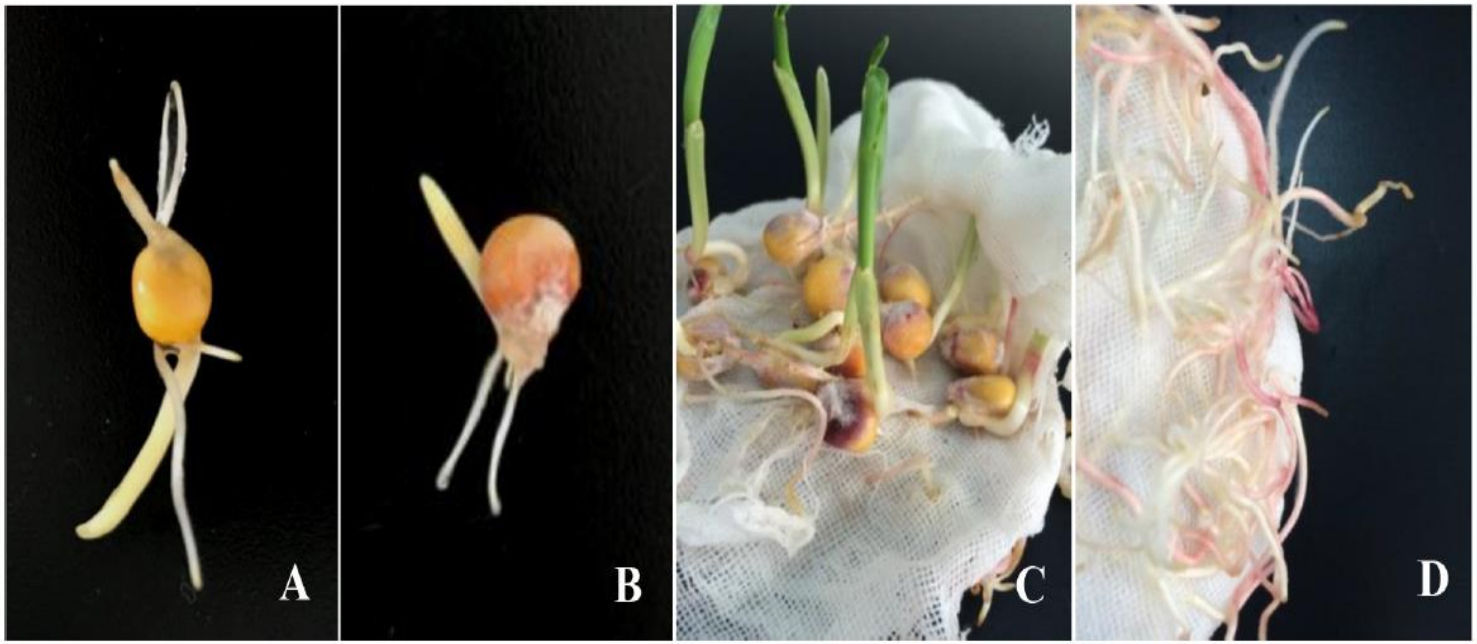


Fig 6. Infection cycle of maize seeds inoculated with *Fusarium verticillioides* strains cultured from fluorescent kernels. A) a healthy maize seed (negative control); B) a seed infected with the re-separated strain of fluorescent kernels; C) discolored seedlings (5-day-growth) with the re-separated strain of fluorescent kernels; D) decayed and discolor radical (5-day-growth) infected with the re-separated strain of fluorescent kernels.

https://doi.org/10.1371/journal.pone.0201588.g006

ALI OD KOLOBARJENJA PRI FUZARIOZAH PRIČAKUJEMO PREVEČ ?????????

- DA ČE SO NJIVSKI TALNI EKOSISTEMI MIKROBIOLOŠKO „MRTVI“ - PREMALO TEKMECEV ZA SUBSTRAT, KI BI FUZARIJSKIM GLIVAM PREPREČILI PREŽIVETJE NA SUBSTRATU

- NI POVSEM RAZISKANO NA KATERIH VSE POLJŠČINAH SE RAZVIJA POSAMEZNA VRSTA RODU FUSARIUM





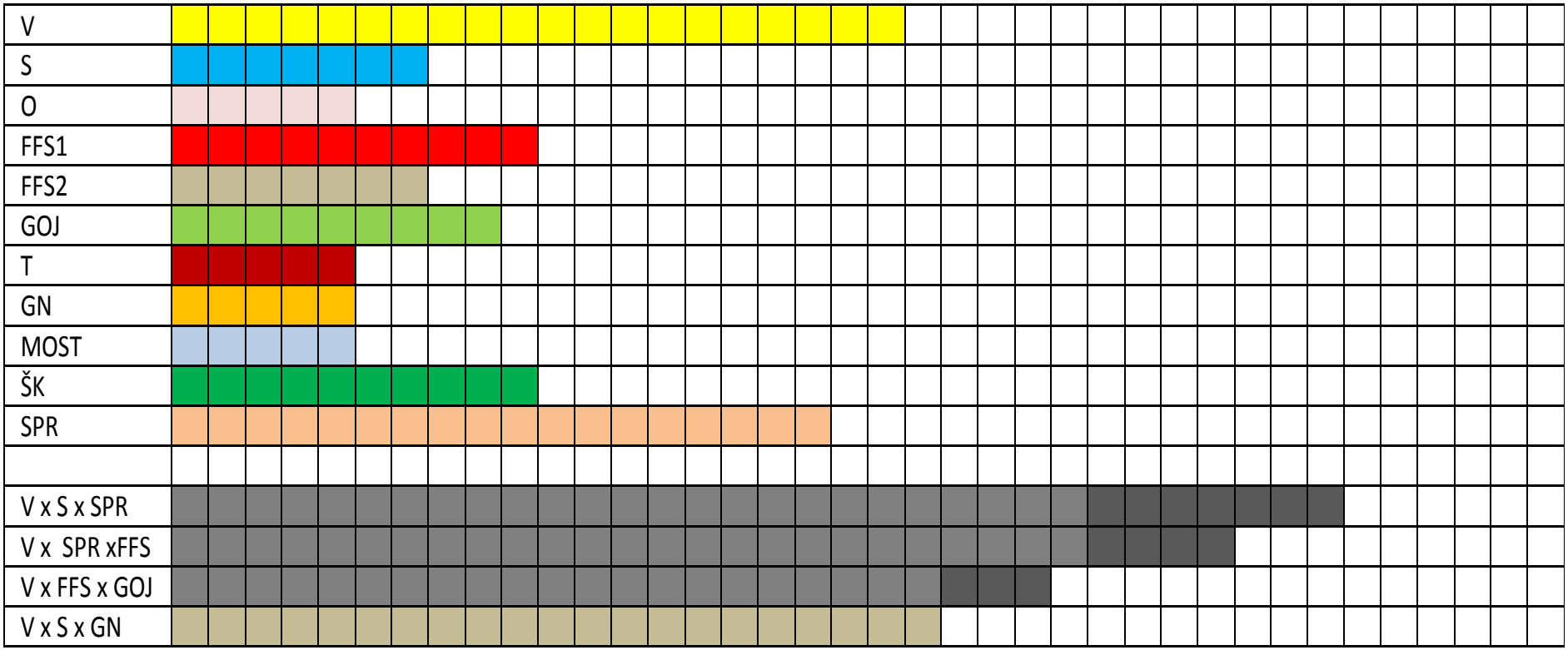








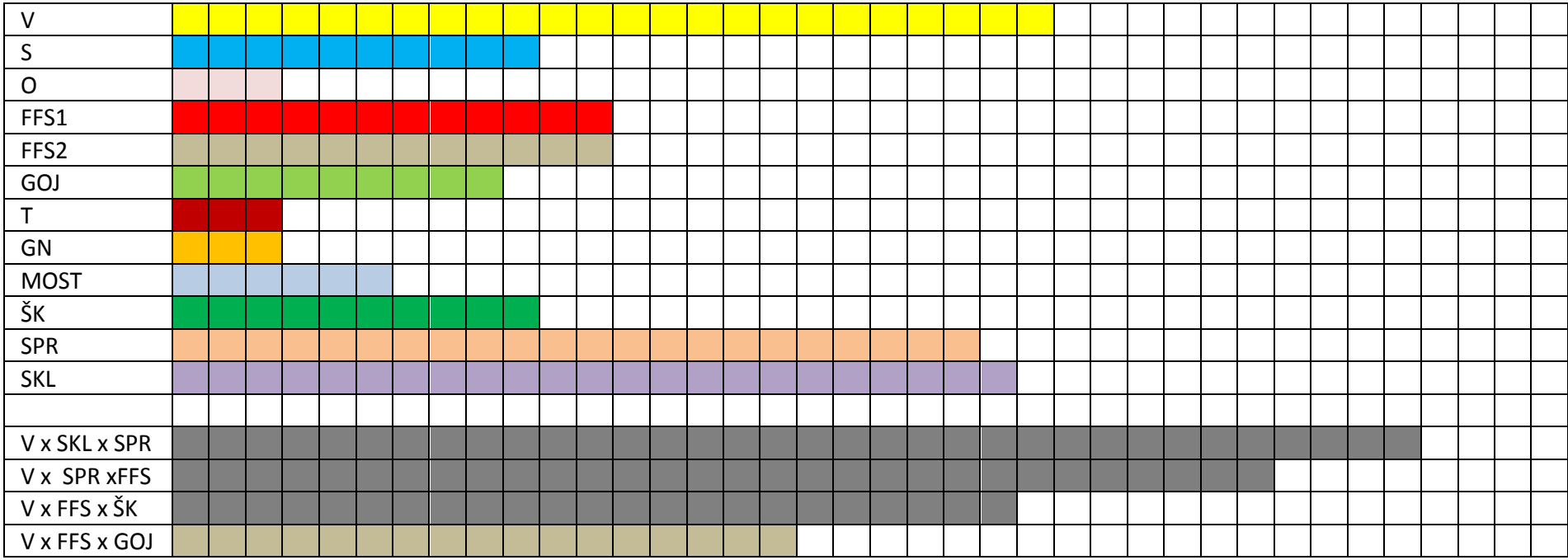
Ohratoksin v vinu - RELATIVNI POMEN varstvo proti ostalim dejavnikom



V	Vreme
S	Lastnosti SORT
O	Obdelava tal
FFS1	Izbor pripravkov – FUNGICIDI
FFS2	Termin uporabe pripravkov in zaporedje
GOJ	Gojitvena oblika trte in zelena dela
T	Tip tal
GN	Gnojenje
MOST	Manipulacija rastlinskih ostankov
ŠK	Zatiranje škodljivcev
SPR	TERMIN IN NAČIN SPRAVILA (kombajni)

Velik pomen odločitev glede tega katere sorte na katerih legah se bodo namenile za pozne trgatve.
Sprotna analiza procesov razvoja plesni pred trgatvijo.
Primernih jeseni in leg za pozne trgatve je vse manj.

Patulin, citrinin in ohratoksin v sokovih in alkoholnih pijačah - RELATIVNI POMEN varstvo proti ostalim dejavnikom V NARAVI IN PRED PROCESIRANJEM



V	Vreme
S	Lastnosti SORT
O	Obdelava tal
FFS1	Izbor pripravkov – FUNGICIDI
FFS2	Termin uporabe pripravkov in zaporedje
GOJ	Gojitvena oblika sadnih rastlin in zelena dela
T	Tip tal
GN	Gnojenje
MOST	Manipulacija rastlinskih ostankov
ŠK	Zatiranje škodljivcev
SPR	TERMIN IN NAČIN SPRAVILA
SKL	NAČIN IN DOLŽINA SKLADIŠČENJA PRED PROCESIRANJEM

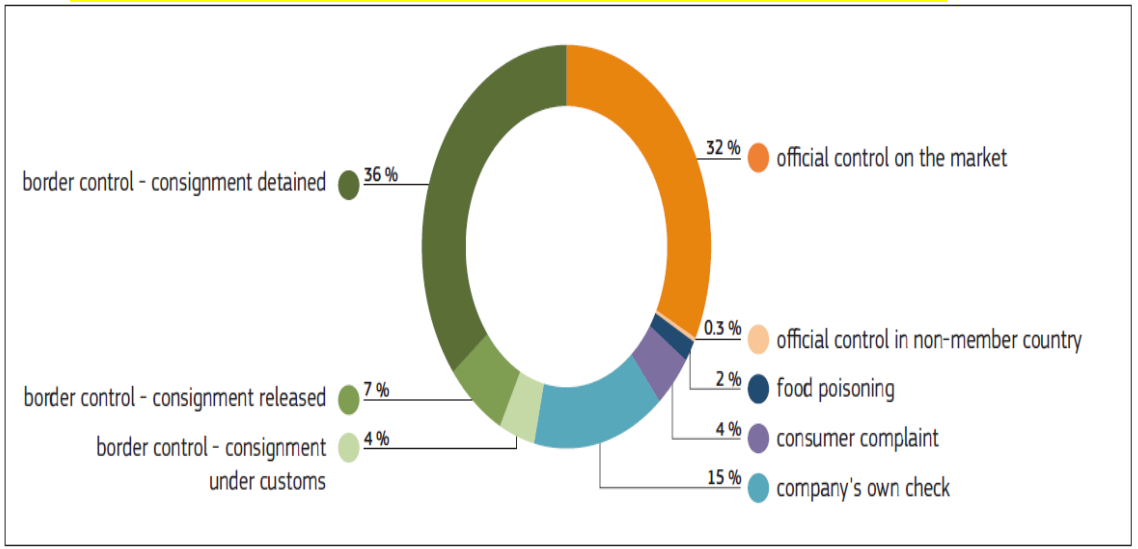
VELIK VPLIV OSEBJA KI TRGA
VELIK VPLIV TEHNIKE LOČEVANJA SADJA PRED PROCESIRANJEM
VPLIV PROCESNIH DODATKOV

Obseg škode zaradi izpostavljenosti mikotoksinom in življenjski slog

Lastnosti mikotoksinov – način vnosa	Lastnosti osebe:
Vrsta mikotoksina (LD50, ARFD, ….)	Starost in spol
Koncentracija posameznega mikotoksina v prehranskem substratu	Izbira in sestava jedilnika – najljubša hrana
Vrsta prehranskega substrata	Urejenost prehrane in gibalni status
Pogostost vnosa nekega prehranskega substrata	Dobro zdravstveno stanje prebavil
Pogostost hkratnega vnosa varovalne hrane	Dobro zdravstveno stanje imunskega sistema
Pogostost hkratnega vnosa obremenilne hrane z drugimi škodljivimi snovmi	Nagnjenost k uživanju drugih škodljivih snovi

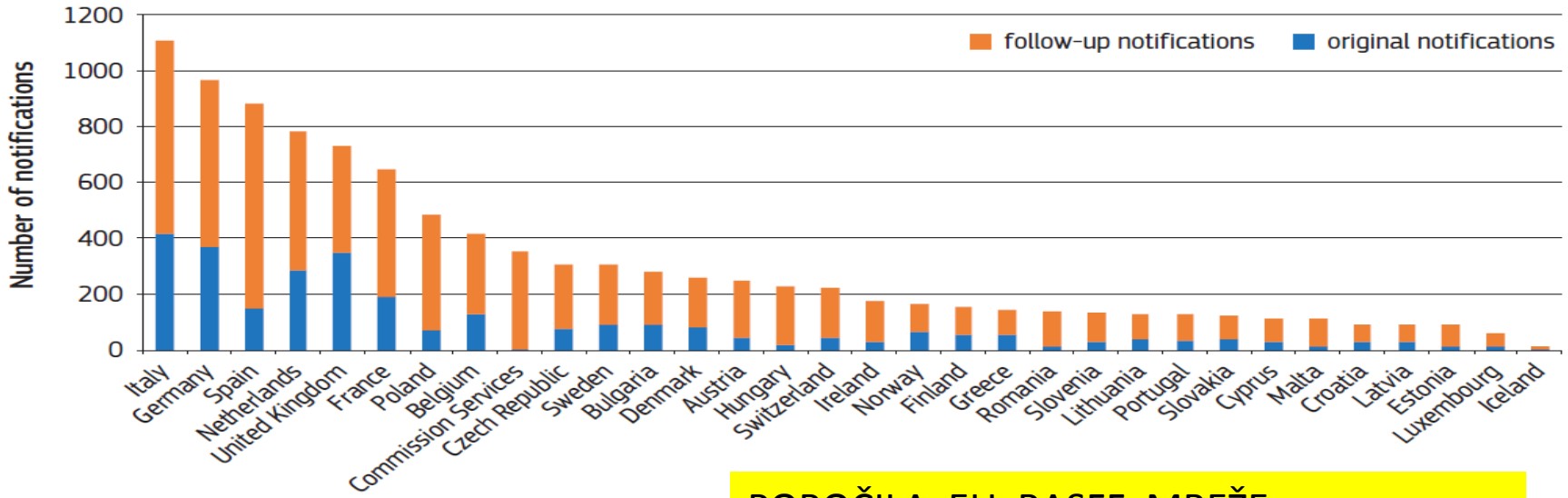


KJE ISKATI INFORMACIJE ??



RASFF notifications by notifying country in 2016

Original and follow-up notifications by notifying country in 2016



POROČILA EU RASFF MREŽE

Top 10 number of notifications by notifying country

Number of notifications counted for each combination of hazard/product category/notifying country

hazard	product category	notifying country	notifications
pesticide residues	fruits and vegetables	Bulgaria	71
aflatoxins	nuts, nut products and seeds	Germany	65
aflatoxins	nuts, nut products and seeds	Netherlands	63
mercury	fish and fish products	Italy	59
aflatoxins	nuts, nut products and seeds	Italy	52
Salmonella	fruits and vegetables	United Kingdom	48
aflatoxins	nuts, nut products and seeds	United Kingdom	31
Salmonella	poultry meat and poultry meat products	Netherlands	29
too high count of Escherichia coli	bivalve molluscs and products thereof	Italy	28
high content of caffeine	dietetic foods, food supplements, fortified foods	Germany	24
pesticide residues	fruits and vegetables	Netherlands	24

Top 10 number of notifications by notifying country

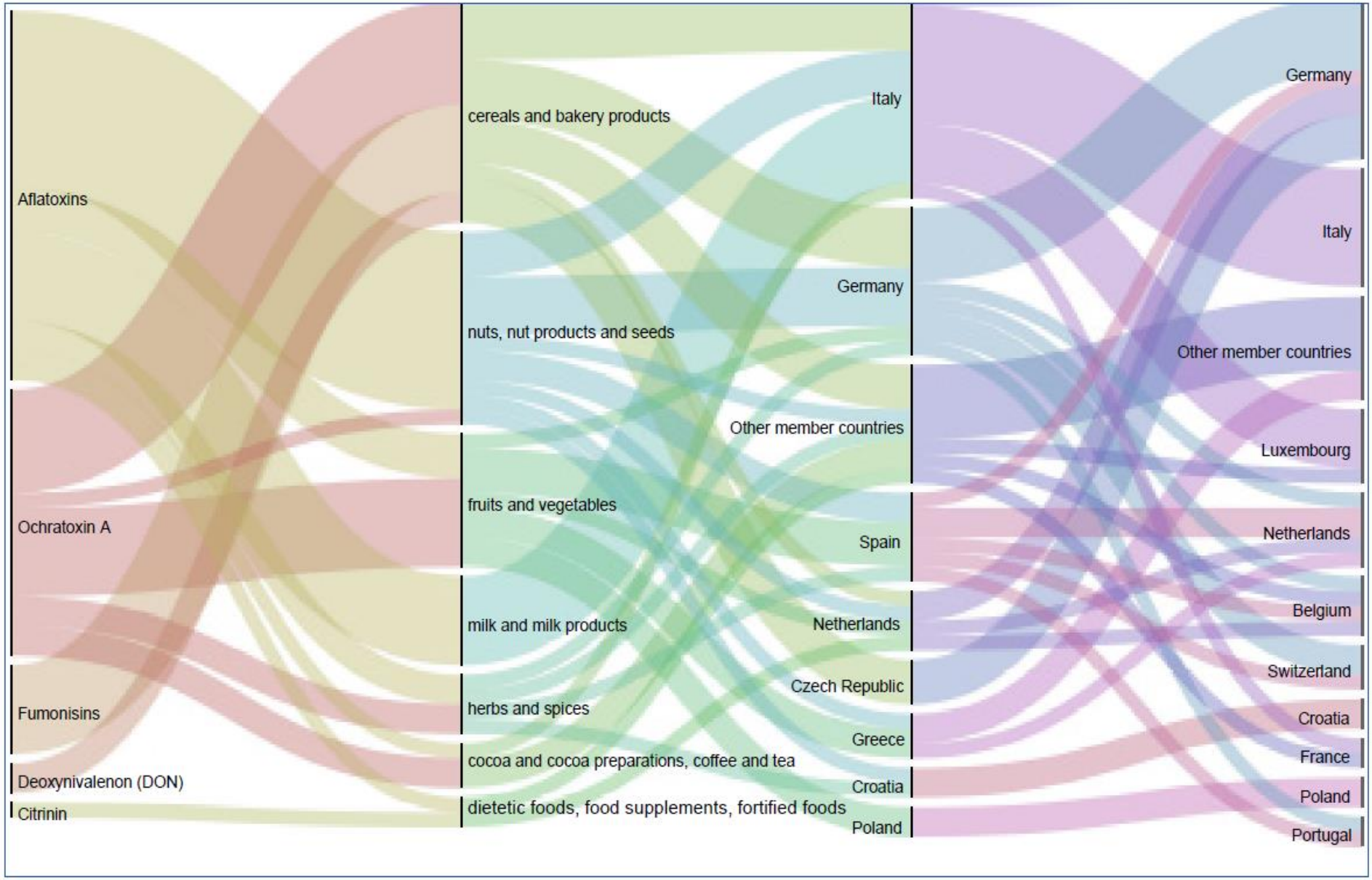
POROČILA EU RASFF MREŽE

Number of notifications counted for each combination of hazard/product category/notifying country.

hazard	product category	notifying country	notifications
Salmonella	poultry meat and poultry meat products	Netherlands	162
mercury	fish and fish products	Italy	98
aflatoxins	nuts, nut products and seeds	Netherlands	82
Salmonella	poultry meat and poultry meat products	Germany	73
fipronil	eggs and egg products	Italy	69
aflatoxins	nuts, nut products and seeds	Germany	66
Salmonella	poultry meat and poultry meat products	United Kingdom	58
aflatoxins	nuts, nut products and seeds	Italy	46
aflatoxins	nuts, nut products and seeds	Spain	42
absence of health certificate(s)	nuts, nut products and seeds	United Kingdom	32

Mycotoxin types in 2016, set out against food product category, set out against member country of origin, set out against notifying country

POROČILA EU RASFF MREŽE

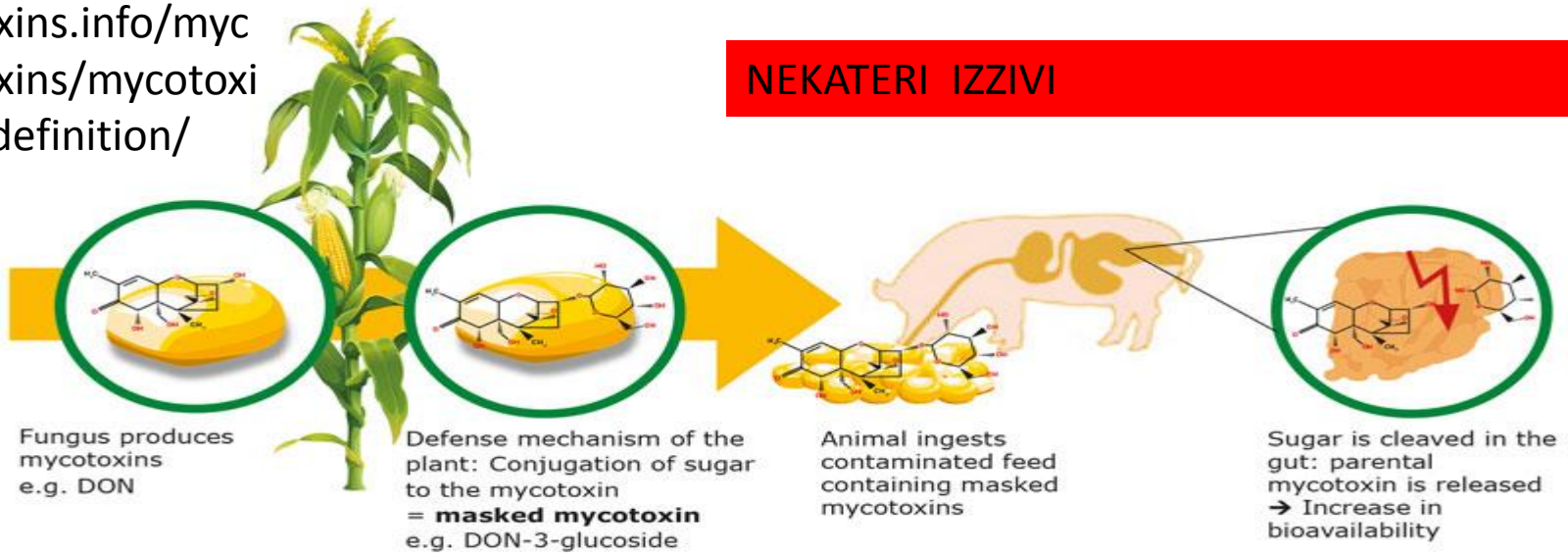


Statistike glede pogostosti pojava mikotoksinov so znane
NPR. OREŠČKI SPADAJO MED NAJBOLJ TVEGAN ŽIVEŽ GLEDE OBREMENITVE Z MIKOTOKSINI



http://www.mycotoxins.info/mycotoxins/mycotoxins-definition/

NEKATERI IZZIVI



PROBLEMI MASKIRANIH MIKOTOKSINOV

PROBLEMI MIKOTOKSINOV GLIV KI JIH UPORABLJAMO ZA BIOTIČNO VARSTVO

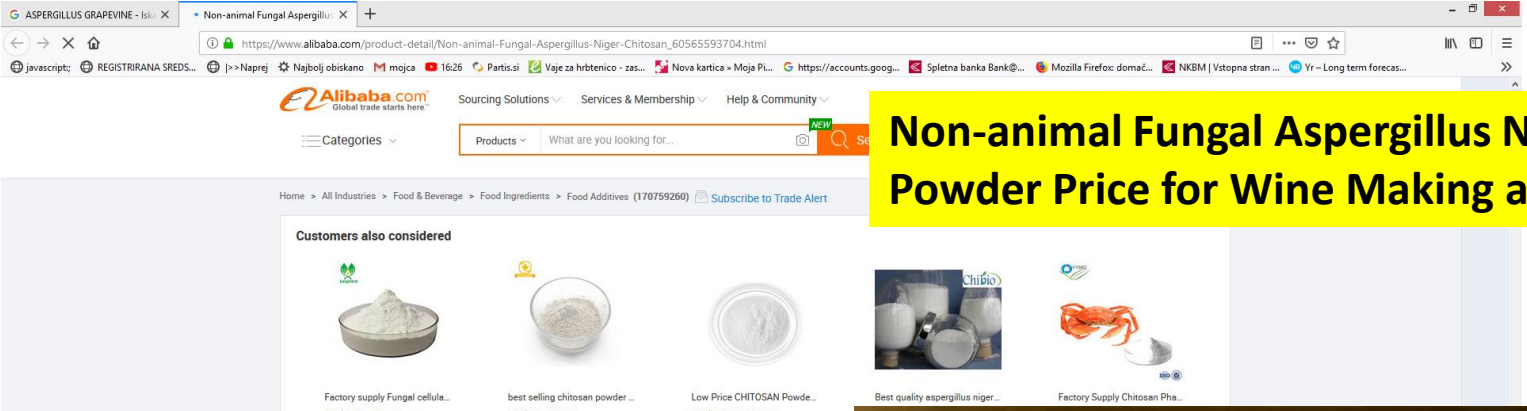
PROBLEMI ENDOFITNIH GLIV, KI JIH UPORABLAMO ZA BIOTEHNOLOŠKO MODIFICIRANJE GOJENIH RASTLIN (ODPORNOST NA STRES IN PATOGENE)

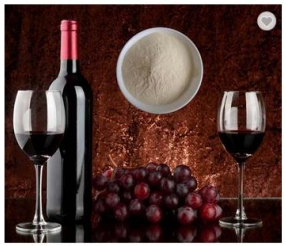
PROBLEMI PREPARATOV, KI JIH IZDELUJEJO IZ GLIV ZA ŽIVILSKO INDUSTRIJO (NPR. PROIZVODNJA HITOSANOV ZA UPORABO V VINU)

NEPREUČENA TOKSIKOLOGIJA MIKOTOKSINOV ŠTEVILNIH GLIV (NPR. COLLETOTRICHUM)

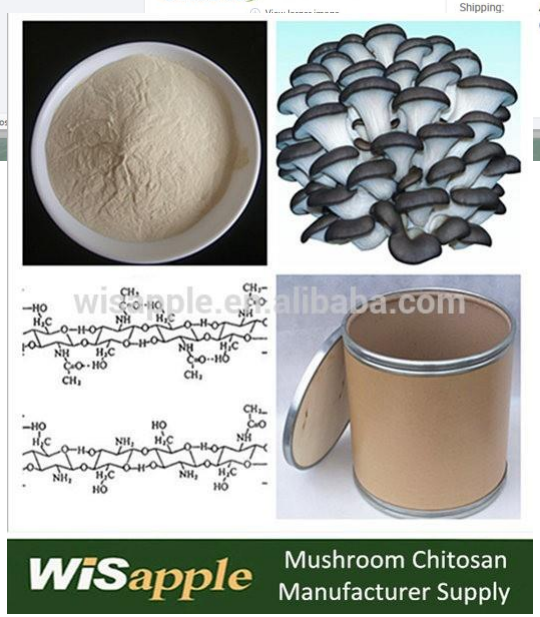
NEKATERI POSTOPKI ZA ODSTRANITEV MIKOTOKINOV POVZROČAJO NASTANEK DRUGIH ŠKODLJIVIH SNOVI

Non-animal Fungal Aspergillus Niger Chitosan Powder Price for Wine Making as Fining Agents









Chibio Aspergillus Niger Chitosan

prašanje toksičnosti mikotoksinov gliv iz rodov Colletotrichum – Gloeosporium



LASTNOSTI TOKSINOV GLIV RODU COLLETORTRICHUM SO ZELO SLABO PREUČENE





PRI NEUSTREZNEM ŽIVLJENJSKEM SLOGU IN NEUSTREZNIH PRAKSAH RAVNANJA Z ŽIVEŽEM V GOSPODINSTVU

LAHKO OD MIKOTOKSINOV UTRPIMO BISTVENO VEČJE ŠKODE ZA ZDRAVJE,

KOT OD DOLGOROČNEGA UŽIVANJA MAJHNIH

OSTANKOV FFS V OBIČAJNIH PREHRANSKIH ARTIKLIH

HVALA ZA POZORNOST

