VĚDECKÝ VÝBOR
FYTOSANITÁRNÍ A ŽIVOTNÍHO PROSTŘEDÍ

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Mykotoxiny, jejich výskyt v surovinách, produktech a krmivech rostlinného původu

Poznámka:

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Předmětem zpracované rešerše je zmapování výskytu mykotoxinů především v potravinách, krmivech a surovinách rostlinného původu. Rešerše je členěna na tři části: v části prvé jsou stručně sumarizovány současné poznatky o mykotoxinech, přičemž hlavní pozornost je věnována látkám produkovaných houbami rodu *Fusarium*, které pro středoevropský region včetně naší republiky představují hlavní riziko. Ve druhé části je zpracován přehled o aktuálním výskytu mykotoxinů v některých evropských zemích za poslední desetiletí a v části třetí je souhrn rešeršních anotací literárních pramenů publikovaných k dané problematice za poslední tři roky.

Část 1: Úvod

Termín mykotoxin je odvozen z řeckého slova "mycos", které znamená houba a z latinského slova "toxicum" znamenající jed. Mykotoxiny jsou definovány jako nízkomolekulární sekundárně metabolické produkty houbových organismů, toxické pro rostliny i teplokrevné živočichy včetně člověka. Z hlediska historické posloupnosti poznávání účinku těchto látek lze mykotoxiny zařadit do několika hlavních skupin: alkaloidy produkované houbou *Claviceps purpurea*, aflatoxiny, ochratoxin, trichothecény a fumonisiny.

V textu používané zkratky: deoxynivalenol – DON, nivalenol – NIV, T-2 toxin – T-2, HT-2 toxin – HT-2, zearalenone – ZEA, fumonisiny – FUM, moniliformin – MON, aflatoxiny – AFL, ochratoxin A - OTA

Ergotoxin, ergotamin

Prvními poznanými mykotoxiny byly produkty houby *Claviceps purpurea* nazvané později ergotoxin a ergotamin. Tyto alkaloidy, které v malém množství jsou lékem, jsou i poměrně silnými jedy. Jejich konzumace může končit i smrtí.

Aflatoxiny

Dosud nejintenzivněji studovanými byly toxické metabolity produkované rody *Aspergillus* a *Penicillium.* Karcinogenní mykotoxiny aflatoxiny a ochratoxin byly prvními podrobně popsanými látkami tohoto charakteru. Aflatoxiny jsou typickými toxiny kontaminujícími suroviny produkované v tropických a subtropických regionech. Jsou produkovány určitými druhy *Aspergillus* a nalézají se na různých nezpracovaných výrobcích, jako například obilniny, dehydrované ovoce, koření, fíky a sušené ovoce. Mezi více než dvaceti druhy aflatoxinů, které jsou známy, se pouze čtyři vyskytují na potravinách (aflatoxiny B1,B2,G1 a G2). Odvozené aflatoxiny se mohou nalézat také v mléku a v mléčných výrobcích (aflatoxiny M1 a M2). Tyto odvozeniny jsou produkovány v procesu trávení přežvýkavci, kteří jsou krmeni kontaminovanými krmivy. Aflatoxiny způsobují množství patologických změn, včetně rakoviny jater, chronické hepatitidy, žloutenky a cirhózy. I když mykotoxiny jsou jedovaté pouze ve velkém množství, vystavení se velmi malým dávkám alfatoxinů po dlouhou dobu může být také zdraví nebezpečné. Určité aflatoxiny mohou také způsobovat genetické mutace v lidských i zvířecích buňkách. Jako výsledek kontrol potravinářské produkce v rozvinutých zemích světa je těžká otrava aflatoxiny velmi nepravděpodobná. Množství aflatoxinů v nezpracovaných potravinách bylo redukováno důslednými kontrolními mechanismy používanými ještě před jejich prodejem. Nadto ve většině zemí existují pravidelné a systematické kontroly množství aflatoxinů v základních prvotních surovinách (obiloviny,dehydrované ovoce,atd.). Pečlivě se také kontroluje maso a mléko. Na druhou stranu, obyvatelé méně rozvinutých oblastí světa, hlavně Afriky a Asie, jsou více vystaveni riziku otravy aflatoxinem. Nicméně tato rizika se týkají i ostatních států, a to v důsledku

mezinárodního obchodu. Nebezpečí spojená s přítomností aflatoxinů a ostatních mykotoxinů se dotýkají dovážejících zemí stejně jako pěstitelských. Z tohoto důvodu se kontroly vysoce rizikových produktů provádějí,jakmile dorazí do třetí země. Celá řada zemí reguluje hladinu aflatoxinů v produktech určených pro potraviny a zvířecí krmivo. Evropská unie také určila maximální limity schválené pro značné množství potravin, včetně sušeného a dehydrovaného ovoce,obilniny a také mléko a mléčné výrobky. V podmínkách České republikay jsou tyto mykotoxiny zjišťovány v surovinách z dovozu a dále při kontaminaci skladovaných produktů.

Ochratoxin A

Obdobně je významným toxinem produkovaným tzv. skladovými plísněmi i ochratoxin A. Jeho výskyt je zaznamenáván v některých regionech (západní Evropa, Kanada a některé oblasti v Jižní Americe), kde je tvořen druhem *Penicillium verrucossum*, plísní,která se často tvoří během skladování obilnin.Také se nalézá v tropických oblastech, kde je produkován jiným druhem houby, *Aspergillus ochraceus*.

Fusariotoxiny

V současné době roste zájem o studium rodu *Fusarium*, jehož většina druhů je patogenních se schopností vyvolávat onemocnění celé řady hostitelských rostlinných druhů a v průběhu patogenního procesu produkovat sekundární metabolity toxického charakteru. Historicky první zmínky o akutních a chronických mykotoxikozách hospodářských zvířat a lidí souvisejících s konzumací obilnin kontaminovaných druhy *Fusarium* spp. jsou staré více než 100 let. Historická a epidemiologická data indikují mnohé další souvislosti mezi častými epidemiemi chorob a konzumací zrnin infikovaných *Fusarium* spp. Jsou známy případy alimentární toxické aleukie, celé řady nemocí jako např. anemií, imunosupresí, krvácení, abortace plodů apod. z mnoha zemí světa. K dispozici je velké množství vědeckých publikací a monografií věnovaných těmto problémům. Z nich také v poslední době vyplývá v souvislosti se studiem případů získaného imunitního selhání (AIDS) popis tzv. pseudo AIDS syndromů po konzumaci mykotoxinu nivalenolu. Kontaminace surovin pro výrobu potravin a především krmiv těmito látkami způsobuje v celosvětovém měřítku značné ztráty především snížením užitkovosti hospodářských zvířat. Ke kontaminaci hostitelských rostlin houbami rodu *Fusarium* dochází již v průběhu vegetace a stejně tak jsou v tomto období již detekovatelné významné hladiny toxických látek. Maximální úrovně obsahu toxinů jsou zaznamenávány v období sklizně a dále se významněji nemění. V současné době publikované údaje uvádí, že ze 61 druhů *Fusarium spp*, které byly izolovány z rostlin a surovin pro výrobu potravin, byla u 35 prokázána schopnost v laboratorních podmínkách produkovat sekundární toxické metabolity. Celkový počet dosud popsaných sekundárně-metabolických sloučenin je 137 (de Nijs et al., 1997). Hlavními skupinami mykotoxinů produkovaných *Fusarium* spp. jsou látky známé pod triviálními názvy trichothecény, zearalenon, fumonisiny, moniliformin a kyselina fusarová.

Pod triviálním názvem ***trichothecény*** je dnes zahrnuta široká skupina chemických sloučenin sesquiterpenoidní struktury, jež inhibují syntézu eukariotických proteinů. Jedná se o bezbarvé látky vysoce stabilní v kyselém prostředí, méně stabilní v silně alkalickém prostředí. Všechny přirozeně se vyskytující trichothecény obsahují vazné C9 a C10 a epoxy-skupinu na C12 a C13 a obvykle hydroxyl- nebo esterovou skupinu na C3, C7, C8 a C15. Molekulová hmotnost kolísá v rozmezí 200-500. Někdy se skupina dělí na trichothecény (= major metabolites) a apotrichothecény (= minor metabolites), které se liší velikostí molekuly a stereochemií kruhu.. Názvy některých nejznámějších trichothecénů jsou T-2 toxin, acetoscirpenol, deoxynivalenol, diacetoxyscirpenol apod. LD 50 je u většiny trichothecénù srovnatelná s aflatoxiny. Trichothecény jsou produkovány mnohými druhy *Fusarium* spp.,

které jsou závažnými patogeny široké škály rostlin. Akutní fytotoxicita a jejich výskyt v rostlinných pletivech samozřejmě také nastolují otázky jejich úlohy v procesu fytopatogeneze.

Další skupinu fusariotoxinů tvoří ***fumonisiny***. Jako chemické sloučeniny byly popsány v roce 1988. Jedná se o sloučeniny na bázi aminopolyalkoholů se strukturou podobnou sfingolipidům. Fumonisiny inhibují aktivitu sfingosin N-acetyltransferázy. V současné době je prokázána vysoká akutní toxicita těchto látek pro jaterní a ledvinové buňky u teplokrevných živočichů. Zatímco trichothecény byly detekovány u celé řady hostitelských rostlinných druhů, fumonisiny jsou zatím prokazovány převážně ze vzorků kukuřice po napadení *Fusarium moniliforme*. Z *Fusarium moniliforme*, izolát MRC 826, získaného z kukuřice určené pro lidký konzum v Jižní Africe, byly také tyto látky s karcenogenními a hepatoxickými účinky poprvé izolovány a popsány (Gelderblom et al., 1988, Bezuidenhost et al., 1988). Fumonisiny jsou karcinogenní pro laboratorní krysy a vyvolávají akutní toxikozy domácích zvířat (např. koňská leukoencephalomalasia, plicní edémy apod.). Podle mezinárodní agentury pro výzkum rakoviny Světové zdravotniocké organizace (IARC-WHO) jsou klasifikovány jako možné karcinogeny pro člověka (třída 2B). Jsou to látky navozující zhoubné bujení. Fumonisiny jsou strukturálně podobné sfingosinu a mohou uplatnit svou biologickou aktivitu v blokaci klíčových enzymů biosyntézy sfingolipidů (Norred, 1993). Důležitou vlastností fusariotoxinů obecně, která byla experimentálně ověřena i u fumonisinu, je jejich termostabilita. Sloučenina byla detekována metodou TLC při následujících kombinacích teplota-čas: 150^{o}C-10 min., 125^{o}C-38 min., 100^{o}C-175 min. , 75^{o}C-8 hod.

Často opomíjeným toxinem produkovaným *Fusarium* spp. je kyselina fusarová. Toxicita této látky pro teplokrevné živočichy je ve srovnání s trichothecény a fumonisiny podstatně nižší, ale nejnovější experimenty prokázaly, že tato látka zesiluje toxické účinky ostatních fusariotoxinů. Tento toxikologický synergizmus může být do určité míry vysvětlením skutečnosti, že zkrmování přirozeně kontaminovaného krmiva má mnohdy výrazně vyšší negativní účinky na konzumenta, než zkrmování krmiva uměle kontaminovaného shodným toxinem.

Aby výčet fusariotoxinů byl úplný, je třeba uvést ještě skupinu sloučenin pod názvem zearalenony. Jedná se o látky se silným estrogenním účinkem, po jejichž konzumaci dochází k reprodukčním poruchám a poruchám fertility.

Detekce mykotoxinů

Mykotoxiny se stanovují různými metodami. Zřejmě nejpřesnější metodou, která je považována za standardní, je kapalinová choromatografie, v běžném screeningu se většinou využívá imunoenzymatických analýz (ELISA) nebo chromatografie na tenké vrstvě. Serologické testy ELISA použili pro stanovení fusariových mykotoxinů v zrně obilovin v poslední době např. v USA Abuozied et al. (1991) pro DON a ZON a Bebbet et al. (1994) pro ZON a na Novém Zélandu Lauren a Agnew (1991) pro NIV, DON. scirpentriol a T-2-tetraol. Pestka et al. (1995) přinesli obsáhlý přehled (70 liter. citací) o imunologických postupech detekce mykotoxinů v obilovinách a cereálních potravinách. Všechny tyto metody jsou dostatečně přesné a citlivé a při srovnání výsledků dosažených HPLC a ELISA metodou je dosahováno vysokých korelací (Castelo et al. 1998). Přesto existují rizikové faktory, které je třeba při analytice mykotoxinů minimalizovat. Prvním z nich je odběr vzorků. Vzhledem k závažnosti tohoto experimentálního kroku byl dokonce vzorkovací postup upraven v roce 1994 direktivou EU č. 98/53/EC. Tato direktiva určuje postup především při odběru vzorků krmiv pro stanovení obsahu mykotoxinů. Druhým rizikovým faktorem je purifikace a extrakce vzorků. Při nedokonalé purifikaci mohou zůstat mykotoxiny maskovány jinými látkami a tak může být získán falešně negativní výsledek. V souvislosti s analýzou mykotoxinů je třeba také uvést, že obsah mykotoxinů nekoreluje s výskytem nativních původců těchto látek či s obsahem jejich spor. Indikací možného hygienického problému

může být sice viditelný výskyt povlaku mycelia (u *Fusarium* spp. většinou bělavý nebo růžový), ale přesto musí následovat analytické stanovení toxických látek.

Vzhledem k tomu, že většina problémů s obsahem mykotoxinů souvisí s krmivy pro hospodářská zvířata, bude v následujícím textu uvedeno několik poznámek k této problematice. Při podezření na mykotoxikózu u zvířat je třeba ihned po projevení příznaků (odmítání krmiva, zvracení aj.) odebrat vzorek krmiva pro následnou analýzu. Krmiva v tomto případě by měla být vyšetřena na přítomnost dvou až čtyř toxických látek: l. deoxynivalenol, 2. T-2 toxin, 3. zearalenon, 4. dle složení krmiva fumonisiny nebo ochratoxin. Je samozřejmé, že v krmivu se mohou vyskytovat desítky dalších mykotoxinů, které mohou také negativně ovlivnit zdravotní stav zvířete. Přesto pro odpověď, zda zdravotní potíže jsou vyvolány mykotoxiny by mělo postačovat stanovení výše uvedených čtyř sloučenin. V této souvislosti je třeba opět poznamenat, že dosud opomíjeným toxinem produkovaným *Fusarium* spp. byla kyselina fusarová. Toxicita této látky pro teplokrevné živočichy je ve srovnání s trochothecény a fumonisiny podstatně nižší, ale nejnovější experimenty prokázaly, že tato látka zesiluje toxické účinky ostatních fusariotoxinů. Tento toxikologický synergizmus může být do určité míry vysvětlením skutečnosti, že zkrmování přirozeně kontaminovaného krmiva má mnohdy výrazně vyšší negativní účinky na konzumenta, než zkrmování krmiva uměle kontaminovaného shodným toxinem.

Limity

Monitoring výskytu fusariotoxinů se provádí v mnoha evropských zemích a začíná se realizovat i v České republice. Jsou k dispozici údaje o kontaminaci kukuřice především mykotoxiny DON, FUM a ZEA z Rakouska, Itálie i jiných zemí. Publikované údaje z ČR např. uvádí, že po sklizni v roce 1996 bylo v souboru vzorků pšenice a ječmene nalezeno 54% vzorků pozitivně kontaminovaných především DON a ZEA s průměrnou koncentrací 605 μg/kg. Vzhledem k tomu, že legislativa určující maximální povolené hladiny fusariotoxinů v surovinách a krmivech se teprve vytváří, je velmi obtížné podobné výsledky interpretovat. Prvním komplexnějším materiálem stanovujícím limity obsahů mykotoxinů je směrnice EU 1525/98 s účinností od 1.1.1999. Pouze v některých zemích jsou určeny národní hodnoty kontaminací v souladu s dokumenty FAO, které již mohou vyvolat klinické příznaky mykotoxikóz. V Rakousku jsou uváděny hodnoty pro DON (pšenice, rýže 500 μg/kg) a ZEA (pšenice, rýže 60 μg/kg), Francie má limity pro ZEA v potravinách na úrovni 200 μg/kg, pro FUM je limit ve Svýcarsku na úrovni 1000 μg/kg. Limity na severoamerickém kontinentu se u DON u pšenice pohybují od 1000 μg/kg (USA) do 2000 μg/kg (Kanada) (Usleber, Martbauer, 1998).Obecně lze tedy uvést, že limitní koncentrace u většiny fusariotoxinů v případě potravin se budou pohybovat na úrovni 1 mg/kg samozřejmě také v závislosti na akutní toxicitě. Pro ilustraci LD 50 orálně u myší je u DON 70 mg/kg, u ZEA 20.000 mg/kg, ale u T-2 jen 10 mg/kg.

Dopad na zdravotní stav však závisí nejen na množství toxických látek v krmivu, ale také na celkovém stavu zvířete, druhu a stáří i na dalších podmínkách prostředí. V této souvislosti je často diskutována i možnost vzniku reziduí mykotoxinů v potravinových surovinách živočišného původů po konzumaci mykotoxinů v krmivu hospodářkými zvířaty. Na základě posledních znalostí lze například u fumonisinů uvést, že rezidua v mléce jsou možná, ve vepřových ledvinách a játrech jsou v malém množství také pravděpodobná, ve vepřovém i drůbežím mase a vejcích jsou rezidua těchto látek nepravděpodobná.

V naší republice je problém mykotoxikóz omezem především na fusariotoxiny, které jsou významnými kontaminanty potravinářských a krmivářských surovin. Především při průběhu vegetačního období s nadměrnými srážkami a relativně chladnějším počasí je předpoklad zvýšené kontaminace těmito látkami. Na základě dosavadních výsledků se jeví jako hygienicky i ekonomicky nejzávažnější mykotoxiny DON a ZEA. Zvláště DON by bylo

možné považovat za jakýsi indikátor celkové kontaminace mykotoxiny. První českou zákonnou normou stanovující hladinu mykotoxinů je zákon 110/97 Sb. o potravinách a vyhláška 298/97 Sb. s limity pro aflatoxiny, patulin, ochratoxin A a deoxynivalenol.

Prevence

Problematika mykotoxikóz je problematikou relativně novou a jako nový fenomém je mnohdy nedoceňována. Znovu je třeba zdůraznit, že primární nebezpečí mykotoxikóz nespočívá v konzumaci viditelně kontaminovaných zemědělských produktů, ale spíše v konzumaci makroskopicky nepoškozených potravin či krmiv, kde již není patrná přítomnost houbových organismů, a přesto jsou kontaminovány mykotoxiny. Pozvolná a dlouhodobá akumulace mykotoxinů v buňkách a tkáních konzumenta je tím největším nebezpečím. Nebezpečí je o to větší, že mnohé mykotoxiny jsou látky vysoce termostabilní a ani tepelná sterilizace neinhibuje jejich účinnost. Navíc jako sloučeniny o nízké molekulové hmotnosti poměrně snadno ulpívají i v mikropórech např. skleněných obalů a tyto mohou být zdrojem další kontaminace. Při konzumaci nízkých dávek mykotoxinů může docházet ke zvýšenému nebezpečí sekundárních infekcí, selhávání účinnosti vakcín, zeslabení imunity apod.

Velký význam v boji proti mykotoxikózám mají preventivní opatření. Integrovaný systém pěstování polních plodin respektující nároky daného druhu na optimální stanoviště, výživu a další technologické vazby je jedním ze základních předpokladů zabraňujících kontaminaci houbovými patogenními organismy. Zcela na místě je v rámci technologie pěstování zařazení přiměřené fungicidní ochrany. V této souvislosti neobstojí často užívaný argument o nadměrném zatěžování životního prostředí pesticidy. Srovnáme-li LD 50 běžně užívaných fungicidů s hodnotami, které tento index dosahuje u mykotoxinů je zřejmé, že fungicidní látky jsou mnohdy méně toxické než mykotoxiny. Mykologické a toxikologické rozbory zemědělských produktů a surovin by se měly stát součástí posklizňového procesu. U skladovaných produktů je to o to důležitější, že se zde může vytvářet vhodné mikroklima pro sekundární rozvoj houbových mikroorganismů. Riziko nadměrného růstu houbových mikroorganismů a následné tvorby mykotoxinů lze do určité míry snížit aplikací tzv. "protiplísňových" přípravků. Použití efektivního inhibitoru, který může výrazně omezit rozvoj houbových organismů a jejich metabolickou činnost, se stává nezbytnou součástí přípravy nezávadných krmiv. Hlavními součástmi uvedených přípravků jsou kyseliny a látky snižující korozivnost přípravku a naopak zlepšující mechanické vlastnosti krmiv. Nejčastěji se v těchto přípravcích objevuje kombinace organických kyselin a esenciálních olejů či jiných látek, které jsou účinné proti širokému spektru houbových organismů, zlepšují sypkost naskladněných krmiv a mají sníženou korozivnost. Důležitá z pohledu ochrany konzumenta je také kontrola importovaných surovin a potravin (např. káva, kakaové boby, sója, podzemnice olejná apod.) především z oblastí s méně rozvinutým zemědělstvím a důsledné vyřazování kontaminovaných šarží z potravinných řetězců.

Abuozied,M.M., Azcona,J.I., Braselton,W.E., Pestka,J.J.: Applied and Environmental Microbiology 57, 1991, 3, 672-677.

Bebbet,G.A., Nelsen,T.C., Miller,B.M.: Journal of ADAC International 77, 1994, 6, 1500-1509.

Bezuidenhost,S.C., Gelderblom,W.C.A., Gorst-Allman,C.P., Horak,R.M., Marasas,W.F.O., Spiteller, G., Vleggaar, R. (1988): Structure eluciation of the fumonisins, mycotoxins from *Fusarium moniliforme.* J. Chem. Soc. Chem. Commun., 743-745.

Castelo, M.M., Sumner, S.S., Bullerman, L.B. (1998): Occurence of fumonisins in corn-based food products. J. Food Protec., 61, 704-707.

De Nijs, M., Van Egmond, H.P., Rombouts, F.M., Notermans, S.H.W. (1997): Identification of hazardous *Fusarium* secondary metabolites occurring in food raw materials. J. Food Safety, 17, 161-191.

Gelderblom,W.C., Jaskiewicz,K., Marasas,W.F.O., Thiel,P.G., Horak,R.M., Vleggaar, R, Kriek, N.P.J. (1988): Fumonisins –novel mycotoxins with cancer-promoting activity produced by *Fusarium moniliforme.* Appl. Environm. Microbiology , 54,1806-1811.

Lauren,D.R., Agnew,M.P., Smith,W.A., Sayer,S.T.: Food Addit. Contaminants 8, 1991, 599-605

Norred,W.P. (1993): Fumonisins – mycotoxins produced by *Fusarium moniliforme.* J. Toxicol. Environm. Health 38, 309-328.

Pestka,J., Abouized,M.N., Sutikno (1995): Immunologically-based assays for mycotoxin detection. Food Technol., 49, 120-128.

Usleber, E., Martlbauer, E. (1998): A limited survey of cereals foods from Germany market for *Fusarium* toxins (deoxynivalenol, zearalenone, fumonisins). Archiv fur Lebensmittelhygiene, 49, 25-48.

Část 2: Přehled výskytu toxinogenních hub a mykotoxinů v surovinách, produktech a krmivech rostlinného původu v některých evropských zemích

2.1. Rakousko

Studium mykotoxinů a toxinogenních plísní bylo v Rakousku zahájeno v polovině sedmdesátých let v souvislosti s nespecifikovanou sterilitou skotu. Jako jedna z příčin byl označen ZEA (Lengauer, 1977). Hlavním stimulem k formulaci širokého studijního programu mykotoxinů byly ale až vážné trávicí problémy u prasat v jihovýchodním Rakousku vyvolávané zkrmováním kontaminované kukuřice v zimě 1977/78 (Lew et al., 2001). Již v roce 198O bylo známo spektrum *Fusarium* spp. na hlavních plodinách, tj. kukuřici, pšenici a ovsu. Bylo konstatováno, že nejčastěji detekovanými mykotoxiny byly ZEA, MON, NIV a DON a jeho deriváty. Nebyl zaznamenán naproti tomu významný výskyt AFL a OTA především vzhledem ke klimatickým podmínkám.

V současnosti probíhá v Raousku monitoring výskytu fusariotoxinů na kukuřici (v letech 1996-1998, 20 lokalit v hlavních pěstitelských oblastech, analýzy DON, ZEA, NIV, T-2, FUM, MON). V roce 1996 bylo např. na DON pozitivních 89% vzorků s průměrným záchytem 0,645 mg/kg, 63% pozitivních vzorků na ZEA s průměrem 0,09 mg/kg. V roce 1997 u DONu bylo 66% pozitivních (průměr 0,14 mg/kg), v roce 1998 u téhož toxinu 75% pozitivních vzorků s průměrem 0,38 mg/kg. Rozdíly mezi jednotlivými roky byly způsobeny výraznými diferencemi v průběhu počasí.

K dispozici jsou také výsledky z analýzy tvrdé pšenice na obsah fusariotoxinů (48 vzorků, 5 lokalit). Z výsledků mj. vyplývá, že na některých lokalitách byl zaznamenán vysoký výskyt MON (až 0,88 mg/kg) a většina MON pozitivních vzorků měla i vysoký výskyt DON (až 8,2 mg/kg), ale zároveň nízký obsah ZEA (Adler et al., 1995).

Adler, A., Lew, H., Brodacz, W., Edinger, W., Oberforster, H.: Occurrence of moniliformin, deoxynivalenol and zearalenoe in durum wheat (*Triticum durum* Dusf.). Mycotoxin Res. 11, 1995, 9-15.

Lengauer, E.: Zur Stellung udn Aktualitat von Mykotoxinen in der heimischen Landwirtschaft. In: Aktuelle Probleme der ls Forschung, Linz, 11, 1997, 33-70.

Lew, H., Adler, A., Thimm, N., Krska, R.,Wiedner, G., Schuh, M.: Occurrence of toxigenic fungi and related mycotoxins in plants, food and feed in Austria. In: Occurrence of toxigenic fungi, Cost Action 835, European Commission 2001, 3- 12.

2.2. Kypr

Na Kypru je od roku 1990 systematicky monitorován a kontrolován výskyt AFL a OTA A především u ořechů, obilovin, sušeného ovoce určeného pro export. Z výsledků monitoringu např. vyplývá, že incidence AFL je nejvyšší u podzemnice olejné ve srovnání s dalšími ořechy a obilovinami (nejvyšší záchyt v roce 1997 – 0,785 mg/kg). U ostatních komodit (mandle, lískové ořechy, pistácie) jsou záchyty AFL minimální. Průměrný výskyt pozitivních vzorků na OTA byl u obilovin (kukuřice, pšenice, ječmen) 23,4% a obsah kolísal v rozpětí 0,03 – 0,1 mg/kg. Autoři také konstatují, že ve srovnání s dalšími rozvojovými zeměmi jsou výskyt AFL a OTA nižší a indikuje to efektivitu HACCP kontrolních mechanismů (Ioannou et al., 2001).

Ioannou - Kakouri, E., Aletrari, M., Christou, E., Ralli, A., Koliou, A.: Occurence of mycotoxins in local food in Cyprus. In: Occurrence of toxigenic fungi, Cost Action 835, European Commission 2001, 13- 18

2.3. Česká republika

V letech 1995-1996 bylo na přítomnost fumonisinů analyzováno 210 vzorků kukuřičných produktů (mouka, corn flakes, pop corn aj.) koupených v běžné obchodní síti. Positivních bylo 89% vzorků s průměrným záchytem 180 ng/g a maximem 4594 ng/g. Ve 4% vzorků byl obsah FUM vyšší než 1000 ng/g. Maximální koncentrace FUM byly v kukuřičném chlebu a extrudovaných kukuřičných produktech, relativně nejméně FUM bylo zachyceno v pop cornu a corn flakes. Autoři uvádí, že stejně jako např. ve Švýcarsku, kde je limitní hygienicky přípustná hladina FUM 1000 ng/g kukuřičného produktu, i pro ČR je možné tuto hranici považovat za relevantní (Ostrý, Ruprich 2001).

V letech 1998 a 1999 bylo shromážděno celkem 84 vzorků kukuřice především z lokalit jižní a střední Moravy. Vzorky byly odebírány jednak přímo z porostů (celé palice ve sklizňové zralosti), jednak bylo získáno zrno z výkupních závodů. Cílem experimentů bylo na základě výsledků mykologických a toxikologických analýz určit základní spektrum houbových kontaminantů kukuřice v podmínkách ČR se zvláštním zřetelem na zástupce rodu *Fusarium* a pokusit se ve vzorcích zrna imunoenzymatickou cestou detekovat přítomnost základních toxických metabolitů: DON, T-2, ZEA a FUM. Z přirozeně infikovaných kukuřičných zrn byli v obou sledovaných sklizňových letech v *in vitro* podmínkách izolováni zástupci celkem 7 houbových rodů. S nejvyšší intenzitou se vyskytovaly druhy rodu *Fusarium* (průměrná kontaminace 44,8%), druhým nejčastěji se vyskytujícím byl rod *Stemphylium* (29,3%). Spektrum izolovaných druhů rodu *Fusarium* bylo tvořeno 8 druhy. V obou sledovaných sklizňových ročnících byl druhem s nejvyšší frekvencí *Fusarium graminearum* (1998 – 42,75%, resp. 1999 – 41,7%), druhým nejčastěji se vyskytujícím druhem bylo *F. culmorum.* Na obsah deoxynivalenolu bylo positivně analyzováno 95,2% vzorků. Koncentrace DON se pohybovaly v rozpětí v rozpětí od 25 do 285 μg/kg. Koncentrace T-2 byly zaznamenány v širším rozpětí než u předešlého toxinu a pohybovaly se v rozpětí od 12 do 875 μg/kg. Koncentrace ZEA byly variabilnější než v případě sloučenin trichothecénového typu. V některých vzorcích byly zaznamenány nulové koncentrace (17% vzorků), maximální koncentrace nepřesáhla 110 μg/kg. Nulová koncentrace FUM byla u 7 vzorků z celkového počtu 42 (tj. 17%), u ostatních vzorků se detekované rozpětí pohybovalo od 12 do téměř 1000 μg/kg. Ve srovnání s ostatními třemi zkoumanými sloučeninami bylo u této látky dosaženo v průměru nejvyšších hodnot (Nedělník, 2002).

Sledování kontaminace krmných surovin po sklizni v roce 1996 prokázalo 54% pozitivních nálezů především DON a ZEA (nad 0,2 mg/kg, průměrná koncentrace 0,605 mg/kg) ve vzorcích čerstvě sklizené pšenice a ječmene. U vzorků odebíraných v roce 1998, kdy bylo vyšetřeno 189 vzorků obilnin, byla kontaminace toxiny podstatně nižší. To opět potvrzuje předpoklad, že klimatické podmínky během vegetačního období jsou vedle faktorů rezistence a technologických pěstitelských postupů pro úroveň kontaminace toxiny rozhodujícím faktorem (Paulová 2001).

Nedělník, J.:

Ostrý, V., Ruprich, J.: Fumonisins i a corn-based products and *Fusarium* occurrence in wheat grains in the Czech Republic. In: Occurrence of toxigenic fungi, Cost Action 835, European Commission 2001, 25-36.

Paulová, J.: Mykotoxiny v krmivu, problémy s analytikou a diagnostikou, monitoring a kontrola. In: Sb. Ref. Sem. Mykotoxiny a jejich stanovení metodou ELISA. Praha 18.4.2001, 27-30.

2.4. Finsko

V letech 1987-1988 byly analyzovány obsahy mykotoxinů ve vzorcích ovsa, pšenice, ječmene, rýže, kukuřice, sojových granulí, řepkových semen, rybí moučky, krmiv pro prasata a drůbež vyprodukovaných ve Finsku i importovaných. Všechny vzorky zrn a krmiv obsahovaly DON v koncentraci od 7 do 300 μg/kg. Nižší koncentrace byly zaznamenány u T-2, HT-2, NIV a ZEA.

Přítomnost ZEA byla také analyzována v letech 1992-1993 ve 120 vzorcích hlavních obilnin. Autoři konstatují, že oba ročníky se vyznačovaly excelentní kvalitou suroviny a nebyl zaznamenán výskyt ZEA (Rizzo et al., 2001).

Rizzo, A., Berg., S., Eskoola, M., Perttila, U., Saari, L.: Occurrence of mycotoxins in cereals and foodstuffs in Finland between years 1987-1999. In: Occurrence of toxigenic fungi, Cost Action 835, European Commission 2001, 37-43.

2.5. Francie

Ve Francii jsou pro celou řadu mykotoxinů doporučeny toleranční limity. Pro ochratoxin A je to 5 ppb, pro patulin 5O ug/l (vztaženo k jablečnému džusu), maximální tolerovaná hladina aflatoxinu B1 je 1 ug/kg, suma aflatoxinů potom 10 ug/kg, maximální tolerance pro zearalenone je 200 ug/kg (Bakan, 2001).

V letech 1996-1997 proběhl monitoring výskytu DON, NIV, ZEA a FUM u pšenice a kukuřice. Z výsledků: pšenice 1996 - 40% posit. DON, 28% posit. NIV, 12% posit. ZEA. Pšenice 1997 – 90% posit. DON, 92% posit. NIV, 12% posit. ZEA. Kukuřice 1996 – 84% posit. DON, 78% posit. NIV, 92% posit. ZEA., 72% posit. FUM. Kukuřice 1997 - 76% posit. DON, 47% posit. NIV, 90% posit. ZEA., 66% posit. FUM (Bakan et al., 2001).

Bakan, B.: Occurrence of toxigenic fungi and related mycotoxins in plants, foods and feed in France. In: Occurrence of toxigenic fungi, Cost Action 835, European Comm. 2001, 44-50.
Bakan, B., Cahagnier, B., Melcion, D.: Natural occurrence of *Fusarium* toxins in doestic wheat and corn harvested in 1996 and 1997 – production of mycotoxin by *Fusarium* isolates from these samples. In: In: Occurrence of toxigenic fungi, Cost Action 835, European Commission 2001, 51-53.

2.6. Německo

Rozsáhlý monitoring výskytu mykotoxinů je realizován v Německu. Např. v roce 1995 byla analyzována silážní kukuřice z pěti lokalit. Průměrná kontaminace ZEA byla 0,385 mg/kg sušiny. Obecně méně byla kontaminovány tzv. stay-green typy. Z celkového počtu 298 vzorků bylo positivně analyzováno 293. V další studii byly analyzovány vzoky z různých siláží z let 1993-1994. Téměr všechny vzorky byly positivní na ZEA v průměrné koncentraci 6O ug/kg. Analýzy u pšenice a ječmene také prokázaly poměrně vysokou míru kontaminace. U 19 z 21 vzorků pšenice byl zachycen DON v koncentraci 140-2840 ug/kg, průměr 330 ug/kg. Ze 13 vzorků ječmene bylo positivních 7 s průměrnou hodnotou množství DON 170 ug/kg. Obdobné výsledky jsou také ze sklizně 1998. Bylo kompletováno 84 vzorků hlavních obilnin z 22 lokalit a analyzováno na obsah DON. 85% vzorků bylo positivních (Niessen 2001).

Niessen, L.: Occurrence of mycotoxins and toxigenic fungi in agricultural commodities and foodstuffs in Germany between 1990-1999. In: Occurrence of toxigenic fungi, Cost Action 835, European Commission 2001, 54-62.

2.7. Maďarsko

Oficiální monitoring mykotoxinů začal v Maďarsku před 3O roky. Práce jsou zaměřeny především na ZEA, T-2, DON a OTA. Při průzkumu v letech 1990-1994 v jižním Maďarsku, nejsušší a nejteplejčí části země, byly jako hlavní kontaminanty pšenice a kukuřice nalezeny DON a ZEA (Mesterházy et al., 1995). První výskyt FUM byl popsán v maďarských rostlinných produktech v roce 1993 (Fazekas, Tothné Hajdú, 1995). 22 vzorků kukuřice bez viditelné přítomnosti houbových kontaminantů bylo získáno ze sklizně 1994, uskladněno 3 měsíce a poté analyzován obsah mykotoxinů. U 15 vzorků byl zaznamenán výskyt trichothecénů, byť v relativně nízké kocentraci pod 7O ug/kg (Szigeti et al., 1995). Více než 3000 vzorků krmiv bylo analyzováno na obsah osmi toxinů. Šedesát osm, 92 a 86% vzorků kukuřice, pšenice a soji obsahovalo minimálně jeden z analyzovaných mykotoxinů. U kukuřice dominoval T-2, zatímco u pšenice a soji DON (Rafai, Bata, 1998).

Fazekas, B., Tothné Hajdú, E.: Incidence of fumonisin B1 mycotoxin in maize cultivated in Hungary. Magyar Allatorvosok Lapja 5O, 1995, 515-518.

Mesterházy, A., Bartok, T., Téren, J.: Resistance of cereals to *Fusarium* in relation with the toxin contamination and natural occurrence of *Fusarium* toxins in South Hungary. In: 9 Congress of FOOd Sci. Technol., Budapest, 1995, abst. No. L036.

Szigeti, G., Nagy, G., Széczi, A., Némethné Konda, L.: A mycological survey on feed cereals kept in stock of the crops of 1994. Magyar Allatorvosok Lapja 5O. 1995, 511-514.

Rafai, P., Bata, A.: Occurrence and importance of mycotoxin contamination in Hungary. In: Mycotoxins in the Food Chain, Hung. Acad. Of Sci., Budapest, 1998, 78-111.

2.8. Itálie

Široce diversifikované je studium toxinogenních hub a mykotoxinů v Itálii. Hlavním výzkumným pracovištěm zabývajícím se touto problematikou je Istituto Tossine e Micotossine da parassitti vegetali del CNR v Bari. Rozsáhlý přehled aktuálních údajů je uveden v publikaci Bottalico, Logrieco (2001).

Bottalico, A., Logrieco, A.: Occurrence of toxigenic fungi and mycotoxins in Italy. In: Occurrence of toxigenic fungi, Cost Action 835, European Commission 2001, 69 - 104.

2.9. Norsko

Z Norska jsou k dispozici výsledky monitoringu výskytu mykotoxinů na pšenici, ječmenu a žitu. Nejfrekventovanějším mykotoxinem byl DON, vysoké hladiny byly zaznamenány v letech 1988 a 1992 se suchým jarem a hojností srážek v červenci. Z dalších toxinů byl frekventovaným HT-2 a T-2. Ve srovnání s trichothecény byly koncentrace ZEA nízká (Langseth, Elen, 1996).

Langseth, W., Elen, O.: Differences between barley, oats and wheat in the occurrenec of deoxynivalenol and other trichothecenes in Norwegian grain. J.Phytopathology 144, 1996, 113-118.

2.10. Polsko

Také v Polsku je především díky prof. Chelkowskému věnována mykotoxinům velká pozornost. Vedle pozoruhodných výsledků ve studiu toxinogenních hub je k dispozici rozsáhlá databáze údajů o mykotoxinech. V Polsku jsou nejvíce frekventovány čtyři sloučeniny: DON, NIV, MON, OTA. Fusariotoxiny jsou akumulovány v rostlinách před sklizní, OTA je problémem během skladování. Mimo tyto hlavní mykotoxiny byla v Polsku

zaznamenána kontaminace dalšími 15 fusariotoxiny . V poslední době je pozornost také věnována alternariovým toxinům (Chelkowski et al., 2001).

Chelkowski, J., Perkowski, J., Kostecki, M., Golinski, P.: Toxigenic fungi and mycotoxns in cereals grains and feeds in Poland. In: Occurrence of toxigenic fungi, Cost Action 835, European Commission 2001, 111-130.

2.11. Slovensko

Kukuřičná zrna z přirozeně infikovaných rostlin byla analyzována na obsah ZEA, DON, MO. Všechny vzorky obsahovaly ZEA, 15 z 18 vzorků DON (v maximální koncentraci 16.88 mg/kg) a 11 vzorků bylo pozitivních na MON (Nadubinska et al., 2002). Slovenští kolegové také intenzivně studují kontaminaci kukuřice FUM (Šrobárová et al., 2000).

Nabubinska M., Parich, A., Krska, R., Kandler, W., Šrobrova, A., Eged, S.: Contents of zearalenone, deoxynivalenol, moniliformin and fusaric acid in maize ears from Slovakia naturally contaminated with *Fusarium* spp. J. Appl. Genet. 43A, 2002, 133-140.
Šrobárova, A., Logrieco, A., Nadubinska, M.: Maize kernels infestation by *Fusarium* spp. in the period 1996-1998 in Slovakia. Acta fytotechnica et zootechnica 4, 2000, 90-93.

Část 3: Rešerše – roky 1999-2002

Níže uvedená rešerše vznikla z databázových souborů zadáním klíčových slov Fusarium a mykotoxiny. Obsahuje cca 22O záznamů na dané téma. Dává přehled o širokém tematickém záběru i o významnosti mykotoxinů i o stále intenzivnější výzkumné práci. Nejsou zde pouze záznamy o výskytu mykotoxinů na různých komoditách, ale také studie zabývající se detekcí těchto sloučenin, srovnání různých analytických postupů, možnostmi detoxifikace, apod. Rešerše není v této podobě interaktivní.

TI: Strategies for detoxification of Fusarium mycotoxins and assessing in vivo the relevant effectiveness.AU: Visconti-A; Solfrizzo-M; Avantaggiato-G; Girolamo-A-de; de-Girolamo-A
SO: The-BCPC-Conference:-Pests-and-diseases,-Volume-2.-Proceedings-of-an-international-conference-held-at-the-Brighton-Hilton-Metropole-Hotel,-Brighton,-UK,-13-16-November-2000. 2000, 721-728; 13 ref.
PB: British Crop Protection Council; Farnham; UK
LA: English
AB: Several aspects of possible approaches to reduce Fusarium mycotoxins contamination in agricultural and food commodities are briefly reviewed. Food processing by itself may destroy, reduce or redistribute mycotoxins. In investigating the effect of food processing, it is essential that methods of analysis must be applicable to both starting material and finished product(s). A variety of chemical, microbiological and physical methods have been investigated for intentional treatment of commodities containing the major Fusarium mycotoxins, with different levels of success. The use of non-nutritive adsorbent materials able to bind the toxin, thus reducing its bioavailability, is quite promising as a number of them reduced to some extent the negative effect of mycotoxins. However, detoxification processes that may appear effective in vitro do not necessarily retain their efficacy when tested in vivo. The importance of biomarkers of exposure (or effect) to mycotoxins is stressed as an effective tool to deal with in vivo detoxification. The elevation of the sphinganine-to-sphingosine ratio was used as a biomarker to assess the in vivo effectiveness of activated carbon and colestyramine in binding fumonisins from contaminated diets. Colestyramine was quite effective, both in vitro and in vivo, and is proposed as potential candidate for commercial preparations to ameliorate multi-mycotoxin effects in grains and feeds.
PT: Book-chapter; Conference-paper
IB: 1-901396-59-2
AN: 20003031775

TI: Mutagenic activity of benlate fungicide on growth and production of the toxin fumonisin by Fusarium moniliforme.
AU: Sahab-AF; Nivien-AAS; Soher-EA
SO: Annals-of-Agricultural-Science-Cairo. 2000, 45: 2, 703-715; 27 ref.
LA: English
LS: Arabic
AB: The fungicide Benlate [benomyl] was effective in vitro against Fusarium moniliforme [Gibberella fujikuroi] after 7 days of incubation. Benlate was tested for its mutagenic potency with respect to fumonisin B1 (FB1) production by F. moniliforme. Fumonisin production by

the isolate with low fumonisin B1 production (L) was reduced by 69.1%, 86.4% and 100% at 1.25, 2.50 and 5.00 ppm of Benlate, respectively and by 95.6%, 98.9% and 100% for the isolate with high fumonisin B1 production (H). The linear growth and dry weight of the 6 biotypes induced by Benlate were lower than that of the wild type isolates. The effect of Benlate as a mutagen was greater on the H wild type. Benlate can induce stable and unstable mutants. The Benlate mutants of the H isolate were characterized as 5 arginine requiring mutants, 5 methionine requiring mutants and 3 adenine requiring mutants. Mutants from the L isolate were characterized as 4 arginine requiring mutants, 2 adenine requiring mutants and 1 methionine requiring mutant. Fusarium moniliforme growth and fumonisin production were inhibited on maize grain treated with Benlate at 0.5 g/kg and stored for one month. The germination percentage of maize grain ranged between 15.6% to 28.2% for the L biotype and between 5.7% to 18.2% for the H biotype. The moisture content and Benlate treatment affected fungal infection, fumonisin production, and germination of maize during storage.
PT: Journal-article
AN: 20013015325

TI: Biochemistry and genetics of Fusarium toxins.
AU: Desjardins-AE; Proctor-RH; Summerell-BA (ed.); Leslie-JF (ed.); Backhouse-D (ed.); Bryden-WL (ed.); Burgess-LW
SO: Fusarium:-Paul-E.-Nelson-Memorial-Symposium. 2001, 50-69; 83 ref.
PB: American Phytopathological Society (APS Press); St. Paul; USA
LA: English
PT: Book-chapter
IB: 0-89054-268-6
AN: 20013135845

TI: Deoxynivalenol: a 25 year perspective on a trichothecene of agricultural importance.
AU: Miller-JD; ApSimon-JW; Blackwell-BA; Greenhalgh-R; Taylor-A; Summerell-BA (ed.); Leslie-JF (ed.); Backhouse-D (ed.); Bryden-WL (ed.); Burgess-LW
SO: Fusarium:-Paul-E.-Nelson-Memorial-Symposium. 2001, 310-320; 85 ref.
PB: American Phytopathological Society (APS Press); St. Paul; USA
LA: English
PT: Book-chapter
IB: 0-89054-268-6
AN: 20013135892

TI: Zearalenone: mycotoxin or mycoestrogen?
AU: Hagler-WM Jr.; Towers-NR; Mirocha-CJ; Eppley-RM; Bryden-WL; Summerell-BA (ed.); Leslie-JF (ed.); Backhouse-D (ed.); Bryden-WL (ed.); Burgess-LW
SO: Fusarium:-Paul-E.-Nelson-Memorial-Symposium. 2001, 321-331; 83 ref.
PB: American Phytopathological Society (APS Press); St. Paul; USA
LA: English
PT: Book-chapter
IB: 0-89054-268-6
AN: 20013135893

TI: Fumonisins - occurrence, toxicology, metabolism and risk assessment.
AU: Marasas-WFO; Miller-JD; Riley-RT; Visconti-A; Summerell-BA (ed.); Leslie-JF (ed.); Backhouse-D (ed.); Bryden-WL (ed.); Burgess-LW
SO: Fusarium:-Paul-E.-Nelson-Memorial-Symposium. 2001, 332-359; 184 ref.
PB: American Phytopathological Society (APS Press); St. Paul; USA
LA: English
PT: Book-chapter
IB: 0-89054-268-6
AN: 20013135896

TI: Other significant Fusarium mycotoxins.
AU: Bryden-WL; Logrieco-A; Abbas-HK; Porter-JK; Vesonder-RF; Richard-JL; Cole-RJ; Summerell-BA (ed.); Leslie-JF (ed.); Backhouse-D (ed.); Bryden-WL (ed.); Burgess-LW
SO: Fusarium:-Paul-E.-Nelson-Memorial-Symposium. 2001, 360-392; 214 ref.
PB: American Phytopathological Society (APS Press); St. Paul; USA
LA: English
PT: Book-chapter
IB: 0-89054-268-6
AN: 20013135899

TI: Comparison of two clean-up principles for determination of trichothecenes in grain extract.
AU: Radova-Z; Holadova-K; Hajslova-J
SO: Journal-of-Chromatography,-A. 1998, 829: 1-2, 259-267; 35 ref.
LA: English
AB: Two clean-up principles for the multi-determination of 7 trichothecene toxins (deoxynivalenol [vomitoxin], nivalenol, diacetoxyscirpenol, fusarenon-X, T-2 tetraol, HT-2 toxin and T-2 toxin) in wheat extract are described. For clean-up of acetonitrile-water (84 : 16, v/v) extract, either gel permeation chromatography (Bio-Beads S-X3 gel) or solid-phase extraction (combination of Florisil and C18-silica gel SPE cartridges or a Romer Labs. MycoSep 225 column) were used. The MycoSep 225 column was chosen as the best alternative for clean-up of grain samples. Recovery of this procedure was tested on certified material. Derivatization of analytes prior to the final determinative step was carried out by trifluoroacetic acid anhydride. Trifluoroacyl derivatives of the trichothecenes were separated by high-resolution capillary gas chromatography with electron-capture detection.
PT: Journal-article
AN: 20023012854

TI: Susceptibility of Kenyan wheat varieties to head blight, fungal invasion and deoxynivalenol accumulation inoculated with Fusarium graminearum.
AU: Muthomi-JW; Oerke-EC; Dehne-HW; Mutitu-EW

SO: Journal-of-Phytopathology. 2002, 150: 1, 30-36; 40 ref.
LA: English
AB: Fifteen wheat varieties commercially grown in Kenya were tested for their susceptibility to head blight and mycotoxin accumulation after inoculation with F. graminearum [Gibberella zeae] in pot experiments. The strains of the pathogen used had been isolated from wheat collected in different growing areas of Kenya. Head blight susceptibility was assessed as the percentage of spikelets bleached and area under disease progress curve; kernel colonization by fungal mycelium was determined as ergosterol content. All varieties were moderately to highly susceptible. However, the varieties differed in head blight susceptibility (29-68% of spikelets bleached; mean 54%), fungal colonization (67-187 µg/g ergosterol content; mean 111 µg/g) and the resulting mycotoxin contamination (deoxynivalenol (DON) 5-31 µg/g; mean 13.5 µg/g). Grain weight reductions due to head blight ranged from 23 to 57% (mean 44%). The varieties could be therefore divided into partially resistant and highly susceptible genotypes. The kernels of highly susceptible varieties had higher mycotoxin and ergosterol contents. However, the kernels of some varieties contained more fungal mycelium (ergosterol) without the corresponding high amounts of DON, suggesting that they possess some resistance to DON accumulation. Less susceptible varieties showed resistance to fungal spread, as indicated by a slow disease development and lower content of fungal biomass.
PT: Journal-article
AN: 20023028800

TI: Molecular mapping of QTLs for Fusarium head blight resistance in spring wheat. I. Resistance to fungal spread (Type II resistance).
AU: Buerstmayr-H; Lemmens-M; Hartl-L; Doldi-L; Steiner-B; Stierschneider-M; Ruckenbauer-P
SO: Theoretical-and-Applied-Genetics. 2002, 104: 1, 84-91; 44 ref.
LA: English
AB: Fusarium head blight (FHB, scab) is a fungal disease of wheat and other small cereals that is found in both temperate and semi-tropical regions. FHB causes severe yield and quality losses, but the most-serious concern is the possible mycotoxin contamination of cereal food and feed. Breeding for FHB resistance by conventional selection is feasible, but tedious and expensive. This study was conducted to identify and map DNA markers associated with FHB resistance genes in wheat. A population of 364 F1-derived doubled-haploid (DH) lines from the cross 'CM-82036' (resistant)/'Remus' (susceptible) was evaluated for Type II resistance (spread within the spike) during 2 years under field conditions. Marker analysis was performed on 239 randomly chosen DH lines. Different marker types were applied, with an emphasis on AFLP and SSR markers. Analysis of variance, as well as simple and composite interval mapping, were applied. Three genomic regions were found significantly associated with FHB resistance. The most-prominent effect was detected on the short arm of chromosome 3B, explaining up to 60% of the phenotypic variance for Type II FHB resistance. A further QTL was located on chromosome 5A and a third one on 1B. The QTL regions on 3B and 5A were tagged with flanking SSR markers, the 1B QTL was found associated with the high-molecular-weight glutenin locus. These results indicate that FHB resistance is under control of a few major QTLs operating together with unknown numbers of minor genes. Marker-assisted selection for these major QTLs involved in FHB resistance appears feasible and should accelerate the development of resistant and agronomically improved wheat cultivars.
PT: Journal-article
AN: 20023036136

TI: Chronic effects of fumonisin B1 in broilers and turkeys fed dietary treatments to market age.
AU: Broomhead-JN; Ledoux-DR; Bermudez-AJ; Rottinghaus-GE
SO: Poultry-Science. 2002, 81: 1, 56-61; 30 ref.
LA: English
AB: Floor pen studies were conducted with 270 broiler chicks and 144 turkey poults (1 week old), to evaluate the chronic effects of fumonisin B1 (FB1). A completely randomized design was used in both studies with six pen replicates of 15 chicks or eight pen replicates of 6 poults assigned to each of three dietary treatments from weeks 1 to 7 (broilers) or to week 14 (turkeys). Fusarium moniliforme (M-1325) culture material was added to a typical corn-soyabean basal diet to supply 0, 25, or 50 mg FB1/kg diet. Feed intake, body weight gain, and feed conversion of chicks were not affected ($P > 0.05$) by FB1. Turkeys fed 50 mg FB1/kg had significantly ($P < 0.05$) lower feed intake than the controls. Compared with controls, chicks and turkeys fed FB1 diets had significantly higher liver sphinganine to sphingosine ratios ($P < 0.05$). Relative organ weights of chicks were not affected ($P > 0.05$) by FB1, other than those chicks fed 25 mg FB1/kg, which had lower ($P < 0.05$) relative proventriculus weights than the chicks fed 0 or 50 mg FB1/kg. Broilers fed 50 mg FB1/kg had decreased serum calcium and increased serum chloride when compared to broilers fed 0 or 25 mg FB1/kg. Haematology was not affected ($P > 0.05$) by dietary FB1. No lesions were present in any organ examined microscopically. Results indicate that 50 mg FB1/kg diet is detrimental to turkeys but is not toxic to broilers fed to market age.
PT: Journal-article
AN: 20023037028

TI: Decreased fumonisin hepatotoxicity in mice with a targeted deletion of tumor necrosis factor receptor 1.
AU: Sharma-RP; Bhandari-N; He-QR; Riley-RT; Voss-KA
SO: Toxicology. 2001, 159: 1-2, 69-79; 40 ref.
LA: English
AB: Fumonisin B1 (FB1), a mycotoxin produced by Fusarium verticillioides and related fungi infests corn and other cereals, and causes a variety of toxic effects in different mammalian species. Hepatotoxicity is a common toxic response in most species. The cellular responses of FB1 involve inhibition of ceramide synthase leading to accumulation of free sphingoid bases and a corresponding induction of tumour necrosis factor alpha (TNFalpha). We recently reported that FB1 hepatotoxicity was considerably reduced in a mouse strain lacking tumour necrosis factor receptor 2 (TNFR2 or TNFR1b). To further investigate the relative contribution of the two TNFalpha receptors (TNFR1 and TNFR2 or P55 and P75 receptors) we evaluated the hepatotoxicity of FB1 in male C57BL/6J mice (WT) and a corresponding TNFR1 knockout (TNFRKO) strain, genetically modified by a targeted deletion of this receptor. The hepatotoxic effects of five daily injections of 2.25 mg/kg per day of FB1 were observed in WT but were reduced in TNFRKO, evidenced by the microscopic evaluation of the liver and increased concentrations of circulating alanine aminotransferase and aspartate aminotransferase. FB1 induced the expression of TNFalpha, and similar increases in free sphinganine and sphingosine in livers of both WT and TNFRKO mice. Results indicated that both P55 and P75 receptors are required for FB1-induced hepatotoxicity and TNFalpha plays an important role in such response in mouse liver.

PT: Journal-article
AN: 20023044680

TI: Apoptosis in mouse fetuses from dams exposed to T-2 toxin at different days of gestation.
AU: Ishigami-N; Shinozuka-J; Katayama-K; Nakayama-H; Doi-K
SO: Experimental-and-Toxicologic-Pathology. 2001, 52: 6, 493-501; 45 ref.
LA: English
AB: T-2 toxin (2 mg/kg b.w.), a type of trichothecene mycotoxin produced by various species of the genus Fusarium, was orally inoculated to pregnant mice at gestational day (GD) 8.5, 9.5, 10.5, 11.5, 12.5, 13.5, 14.5, 15.5 and 16.5, and the fetuses were examined 24 h later. The number and region of pyknotic or karyorrhectic cells varied according to inoculation date. In the GD 13.5-subgroup, a moderate to high number of pyknotic or karyorrhectic neuronal cells were observed in the central nervous system, peri-ventricular zone to subventricular zone, and pyknosis or karyorrhexis were also observed in a small number of chondroblasts and chondrocytes. In the GD 16.5-subgroup, a moderate to high number of pyknotic or karyorrhectic cells were observed in the thymus and renal subcapsular parenchyma. The nuclei of these pyknotic or karyorrhectic cells were strongly stained by the terminal deoxy nucleotidyl transferase (TdT)-mediated dUTP-digoxigenin nick end labelling method widely used for the in situ detection of apoptotic nuclei. In addition, a few fetuses from dams which were given T-2 toxin at GD 13.5 or GD 14.5 and killed at GD 17.5 showed skeletal abnormalities such as wavy ribs and short scapula. From the present findings and the well known fact that T-2 toxin readily crosses the rat placenta, it seems that T-2 toxin-induced apoptosis in the developing mouse fetuses might be a direct effect of T-2 toxin on fetuses.
PT: Journal-article
AN: 20023045436

TI: Kinetics of apoptosis-related genes mRNA expression in the dorsal skin of hypotrichotic WBN/ILA-Ht rats after topical application of T-2 toxin.
AU: Albarenque-SM; Suzuki-K; Shinozuka-J; Nakayama-H; Doi-K
SO: Experimental-and-Toxicologic-Pathology. 2001, 52: 6, 553-556; 23 ref.
LA: English
AB: The expression of apoptosis-related genes mRNAs was examined in the dorsal skin of hypotrichotic WBN/ILA-Ht rats topically applied with T-2 toxin (10 µl of 0.5µg/µl solution), produced by various species of Fusarium. The total mRNA was obtained from skin biopsy samples from each rat at 3, 6, 12 and 24 hours after T-2 toxin treatment (HAT), and reverse transcriptase-polymerase chain reaction (RT-PCR) was carried out with pairs of oligonucleotide primers corresponding to the cDNA sequences of rat p53, bcl-2, c-ki-ras, c-fos and c-jun oncogenes. The expression of c-fos mRNA markedly increased at 3 HAT, peaked at 6 HAT, and greatly decreased at 12 HAT. However it maintained a higher level, compared with the control level, even at 24 HAT. Although not prominent, the expression of c-jun mRNA also showed significant elevation from 3 to 12 HAT. On the other hand, there were no changes in the expression of p53, bcl-2 and c-ki-ras mRNAs throughout the observation period. Judging from the present results and our previous report that epidermal cells developed apoptosis at 12 HAT (Histol Histopathol 1999; 14: 337-342), the induction of c-fos and perhaps of c-jun mRNAs may be associated with T-2 toxin-induced epidermal cell apoptosis.
PT: Journal-article
AN: 20023045441

TI: A collaborative study to validate novel field immunoassay kits for rapid mycotoxin detection.
AU: Saeger-S-de; Sibanda-L; Desmet-A; Peteghem-C-van; de-Saeger-S; van-Peteghem-C
SO: International-Journal-of-Food-Microbiology. 2002, 75: 1-2, 135-142; 16 ref.
LA: English
AB: Kits designed to detect ochratoxin A (OA) and T-2 toxin by a membrane-based flowthrough enzyme immunoassay were studied collaboratively by screening cereals (wheat, rye, maize, and barley) for the presence of these mycotoxins. Sample preparation and test procedure were clearly described in the instruction leaflets included in the kits. A simple methanol-based extraction followed by filtration and dilution steps was prescribed. Reagents were successively pipetted to the membrane of the device, then colour development was evaluated visually. Limits of detection for the ochratoxin A and T-2 toxin tests were 4 and 50 µg kg-1, respectively. Five laboratories took part in the first stage of this study, and five more joined the second stage. Cereal samples (blank, spiked, or inoculated) were shipped with the kits to the participating laboratories, whereas results obtained were confirmed by high performance liquid chromatography with fluorescence detection and by gas chromatography-mass spectrometry for ochratoxin A and T-2 toxin, respectively. Some initial difficulties were encountered. In the second stage, 4 ochratoxin A and 4 T-2 toxin kits were used by 10 collaborators to analyse 21 cereal samples. For the ochratoxin A kits, the percentage of false positive and false negative results were 2 and 4%, respectively. The results of one T-2 toxin kit were outliers and when excluded, the overall percentage false positive and false negative results were 6 and 3%, respectively.
PT: Journal-article
AN: 20023046518

TI: Temporal expression of fumonisin B1-induced tumor necrosis factor-alpha and interferon gamma in mice.
AU: Bhandari-N; Enongene-EN; Riley-RT; Meredith-FI; Sharma-RP
SO: Comparative-Biochemistry-and-Physiology.-C,-Toxicology-and-Pharmacology. 2002, 131: 2, 113-122; 48 ref.
LA: English
AB: Fumonisin B1 (FB1), a toxic metabolite of Fusarium verticillioides, is a carcinogen and causative agent of various animal diseases. Our previous studies indicated the involvement of tumour necrosis factor-alpha (TNFalpha) in FB1-induced toxic responses. To further investigate the time-course of TNFalpha production and signalling, mice (4/group) were treated subcutaneously (s.c.) or per os (p.o.) with either vehicle or 25 mg/kg of FB1 as a single dose and sacrificed at 0, 2, 4, 8, 12 and 24 h after treatment. The TNFalpha expression was increased in liver and kidney after both routes of FB1 exposure without any alterations in spleen. The p.o. route FB1 treatment caused greater hepatotoxicity compared to the s.c. route, as depicted by increased alanine aminotransferase and aspartate aminotransferase level in plasma, observed only after p.o. FB1 treatment. The increase in enzymes at 8 h after p.o. treatment correlated with the highest TNFalpha expression, also noted at 8 h after p.o. treatment, thus further confirming the involvement of TNFalpha in FB1 toxicity. The interferon (IFN)-gamma expression was increased in liver at 4 h after p.o. FB1 treatment, suggesting a possible combined role of TNFalpha and IFNgamma in their induction and hepatotoxicity.
PT: Journal-article

AN: 20023046999

TI: Fusarium moniliforme, F. subglutinans and Aspergillus flavus in maize products in Slovakia.
AU: Pieckova-E; Jesenska-Z
SO: Czech-Mycology. 2001, 53: 3, 229-235; 20 ref.
LA: English
LS: Czech
AB: Ubiquitous microfungi Fusarium moniliforme [Gibberella fujikuroi], F. subglutinans [Gibberella fujikuroi var. subglutinans] and F. proliferatum represent frequent contaminants of maize products and can produce some mycotoxins such as beauvericin, fusaproliferin and, the most important, fumonisins A1, A2, B1-B4, C1, etc. Fumonisins are known to cause serious veterinary and potentially, human mycotoxicosis. The aim of our study was to characterize the incidence of F. moniliforme and F. subglutinans in the presence of Aspergillus flavus in maize products produced in Slovakia during 1995-98. One hundred and forty samples of maize grain, groat, semolina and flour; 28 samples of maize straw, husk and silk; and soil from the maize fields were mycologically evaluated for the named strains using potato dextrose agar with 0.02% chloramphenicol and 0.3% of 0.2% Botran and incubation in dark at 25°C for 7-10 days. No Fusarium sp. and A. flavus strains were present in 40% of the maize samples. The highest number of F. moniliforme, F. subglutinans and A. flavus isolates were encountered in flour samples in 1996 (4264 cfu/g on average), in groat in 1998 (17743.7 cfu/g on average) and in groat in 1996 (353 cfu/g on average). Twenty-two percent A. flavus isolates and 10 F. moniliforme strains were tested for their ability to produce aflatoxins or fumonisin B1, in vitro. No aflatoxin-producing A. flavusisolate was found, but all tested F. moniliforme strains produced fumonisin B1 in amounts detectable by TLC. According to the results presented in this paper, it is evident that strains of F. moniliforme, F. subglutinans and A. flavus were not very important contaminants of maize products from crops harvested in 1995-98 in Slovakia.
PT: Journal-article
AN: 20023053800

TI: In vitro control of growth and fumonisin production by Fusarium verticillioides and F. proliferatum using antioxidants under different water availability and temperature regimes.
AU: Etcheverry-M; Torres-A; Ramirez-ML; Chulze-S; Magan-N
SO: Journal-of-Applied-Microbiology. 2002, 92: 4, 624-632; 28 ref.
LA: English
AB: This study was conducted to examine the effect of butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), trihydroxybutyrophenone, and propylparaben (PP) (at concentrations of 1-20 mmol litre-1) on growth of and fumonisin production by Argentinian strains of F. verticillioides (3 strains) and F. proliferatum (4 strains). Studies on lag phases prior to growth, relative growth rates, and fumonisin concentrations were carried out in vitro in relation to water activity (0.995-0.93 aw) and temperature (18 and 25°C) on a maize meal agar. Overall, PP was the antioxidant which was most effective in inhibiting strains of both species. The lag phase prior to growth and growth rates were significantly decreased by PP and BHA at 10 and 20 mmol litre-1, regardless of the temperature or aw level tested. Total fumonisin production was higher at 0.98 aw and decreased by about 45-50% at 0.995 and 0.95 aw. Overall, BHT only inhibited fumonisin production at 0.95 aw at 10 and 20 mmol litre-1, whereas BHA was effective at most aw levels tested at 10 and 20 mmol litre-1. PP completely inhibited fumonisin production by both F. verticillioides and F. proliferatum at > 1 mmol litre-1, regardless of the temperature or aw level. Small interstrain differences in the

levels of inhibition by the antioxidants were observed for the 3 F. verticillioides and 4 F. proliferatum strains at 0.995, 0.98, and 0.95 aw. PP and BHA completely inhibited the growth of both species at the concentrations evaluated, regardless of the aw level. It is concluded that PP and BHA show promise for the control of growth of and fumonisin production by the Fusarium species over a wide range of environmental conditions. Potential exists for using such food-grade preservatives for prevention of mycotoxigenic fungi and their toxins entering the food chain.
PT: Journal-article
AN: 20023056093

TI: Determination of total fumonisins in corn by competitive direct enzyme-linked immunosorbent assay: collaborative study.
AU: Bird-CB; Malone-B; Rice-LG; Ross-PF; Eppley-R; Abouzied-MM
SO: Journal-of-AOAC-International. 2002, 85: 2, 404-410; 16 ref.
LA: English
AB: Fumonisins -- mycotoxins produced by some Fusarium species -- have been shown to be the causative agent of diseases in horses and other domesticated animals as well as possible carcinogens in humans. A collaborative study was conducted to evaluate the effectiveness of a competitive direct enzyme-linked immunosorbent assay (CD-ELISA) for the determination of total fumonisins (B1, B2, and B3) in corn. The test portion was extracted with methanol-water (7+3), filtered, diluted, and tested on the CD-ELISA. Naturally and artificially contaminated corn test portions were sent to 13 collaborators in the United States. Naturally contaminated field test portions were prepared at 3 different levels. Artificially contaminated test portions were spiked at 1.0, 3.0, and 5.0 mg/kg total fumonisins (B1, B2, and B3). Average recoveries of total fumonisins were 120, 100, and 90%, respectively. The relative standard deviations for repeatability ranged from 13.3 to 23.3% and the relative standard deviations for reproducibility ranged from 15.8 to 30.3% across all levels tested. HORRAT values, calculated for each individual sample, ranged from 1.24 to 1.94. This method demonstrated acceptable intra- and interlaboratory precision at the levels tested.
PT: Journal-article
AN: 20023057804

TI: Effects of mycotoxins on human immune functions in vitro.
AU: Berek-L; Petri-IB; Mesterhazy-A; Teren-J; Molnar-J
SO: Toxicology-in-Vitro. 2001, 15: 1, 25-30; 16 ref.
LA: English
AB: Immunosuppressive and carcinogenic Fusarium mycotoxins may appear in domestic food products. Therefore, the immunological effects of Fusarium mycotoxins were tested on human peripheral blood mononuclear cells from different blood donors. In the present study we investigated deoxynivalenol (DON), 3-acetyldeoxynivalenol, fusarenon-X, T-2 toxin, zearalenone, alpha-zearalenol, beta-zearalenol and nivalenol for their effects on T and B cells in a proliferation assay, antibody-dependent cellular cytotoxicity (ADCC) and natural killer (NK) cell activity on human peripheral blood mononuclear cells. The concentrations applied in our experiments were similar to those which can be found in the normal human peripheral blood system (0.2-1800 ng/ml). Among the 8 mycotoxins tested, T-2 toxin, fusarenon X, nivalenol and deoxynivalenol exerted the highest immunosuppressing effect on human peripheral blood mononuclear cells in vitro. Mycotoxin-induced immunosuppression was manifested as depressed T or B lymphocyte activity. Furthermore, by virtue of inhibition of NK cell activity, the protection against tumour development may also be attenuated.

PT: Journal-article
AN: 20023060772

TI: Suppressive effect of zearalenone, an oestrogenic mycotoxin, on bovine neutrophil chemiluminescence.
AU: Murata-H; Shimada-N; Yoshioka-M
SO: Veterinary-and-Human-Toxicology. 2002, 44: 2, 83-86; 17 ref.
LA: English
AB: The effects of zearalenone (ZEA), an oestrogenic mycotoxin produced by Fusarium fungi, on bovine neutrophils were investigated in vitro using chemiluminescence, a bactericidal parameter. ZEA suppressed luminol-dependent, phorbol 12-myristate 13-acetate (PMA)-elicited chemiluminescence in a dose-dependent manner at concentrations of 10-4 and 10-5 M. No significant suppression was observed at concentrations lower than 10-6 M. The possible mode of action of 10-4 M ZEA on the cell activity was investigated with special reference to intracellular Ca2+ ([Ca2+]i) release and oestrogen receptors. The 10-4 M ZEA treatment significantly impaired [Ca2+]i release. When pretreated with a low dose (10-6 M) of PMA, the cells resisted the ZEA-induced chemiluminescence suppression. However, pretreatment of the cells with the oestrogen receptor blockers Tamoxifen and ICI 182,780 (both at 10-6 M) did not annul the suppressive ZEA action. Considering that PMA is an activator of protein kinase C (PKC), a signal transducing enzyme, and in association with a rise in [Ca2+]i causes cytosolic PKC to shift to the plasma membrane where the activated PKC triggers a varied array of cellular responses, the pharmacological dose of ZEA might have suppressed chemiluminescence by hindering the release of [Ca2+]i and the PKC shift. The results of pretreatment with oestrogen receptor blockers, however, did not support the suggestion that the ZEA treatment affected the cells via oestrogen receptor pathways.
PT: Journal-article
AN: 20023062322

TI: Placental transfer of the oestrogenic mycotoxin zearalenone in rats.
AU: Bernhoft-A; Behrens-GHG; Ingebrigtsen-K; Langseth-W; Berndt-S; Haugen-TB; Grotmol-T
SO: Reproductive-Toxicology. 2001, 15: 5, 545-550; 32 ref.
LA: English
AB: In order to study the possible placental transfer of the Fusarium mycotoxin zearalenone (ZON), Sprague Dawley rats were treated with a single dose (0.74 mg/kg body weight) of ZON intravenously on day 12 or day 18 of pregnancy or intragastrically (i.g.) on day 18 of pregnancy. Samples of placenta, fetus and maternal liver and spleen were collected for chemical analyses 0.3 h after treatment on day 12 and 0.3, 4 and 24 h after treatment on day 18. Three rats were used for each pregnancy day, administration route and exposure time. The concentrations of ZON and its metabolites alpha- and beta-zearalenol (-ZOL) were determined quantitatively by high performance liquid chromatography (HPLC) after incubation with beta-glucuronidase and purification on immunoaffinity columns. Tissue distribution was studied by means of whole body autoradiography at 4 and 24 h after treatment with tritiated ZON (750 µCi/kg body weight; 7.4 mg/kg body weight) on day 18 of pregnancy. ZON and alpha-ZOL were transferred into the fetus on both gestational days. However, a delay in distribution into the fetus relative to the maternal tissue was observed. beta-ZOL was below the detection limit in the fetus. No specific site of fetal accumulation of ZON or its metabolites was apparent. In the maternal tissues, the highest levels of ZON and of alpha- and beta-ZOL were found in the liver.

PT: Journal-article
AN: 20023063642

TI: Comparison of Canadian Fusarium graminearum isolates for aggressiveness, vegetative compatibility, and production of ergosterol and mycotoxins.
AU: Gilbert-J; Abramson-D; McCallum-B; Clear-R
SO: Mycopathologia. 2002, 153: 4, 209-215; 25 ref.
LA: English
AB: F. graminearum [Gibberella zeae] is the predominant pathogen causing fusarium head blight of cereals in North America. Fifteen Canadian isolates of F. graminearum were highly diverse in terms of vegetative compatibility grouping (VCG) and varied for production of ergosterol and mycotoxin production in rice culture. Aggressiveness was assessed by scoring the disease severity incited in wheat spikes by each isolate. Two inoculation methods, single-floret injection and spray of entire spikes, were used to screen 4 wheat cultivars (FHB21, FHB37, Katepwa and Roblin) for reaction to the F. graminearum isolates. All isolates were of broadly similar aggressiveness, with disease severity ranging from 17.2 to 39.1 for single floret injection, and 39.1 to 69.0 for spray inoculation. Disease severity, ergosterol production and mycotoxin development were not correlated. The 15 isolates were grouped into 14 VCGs using nitrate non-utilizing mutants. Deoxynivalenol was produced by all isolates in rice culture, at levels between 0.2 and 249 ppm. 15-acetyldeoxynivalenol was produced by 14 isolates at levels between 0.4 and 44.6 ppm. These results reveal a high level of diversity for several characteristics among F. graminearum isolates from Canada.
PT: Journal-article
AN: 20023067918

TI: Toxic effects of the mycotoxin zearalenone and its derivatives on in vitro maturation of bovine oocytes and 17beta-estradiol levels in mural granulosa cell cultures.
AU: Minervini-F; Dell'-Aquila-ME; Maritato-F; Minoia-P; Visconti-A
SO: Eleventh International Workshop on In Vitro Toxicology, Pueblo Acantilado, El Campello (Alicante), Spain, 25-28 October 2000. Toxicology-in-Vitro. 2001, 15: 4-5, 489-495; 24 ref.
LA: English
AB: Moulds of livestock foodstuffs alter the quality of grains by synthesizing mycotoxins. Zearalenone (ZEA) and its derivatives (alpha- and beta-zearalenol, zeranol, taleranol and zearalanone) are produced by fungi of the genus Fusarium and, after ingestion via contaminated cereals, may lead to fertility disturbances and other reproductive pathologies. Zearalenone, alpha-zearalenol and zearalanone were tested, at levels ranging from 0.3 to 30 µg/ml, in order to evaluate the effect on the in vitro maturation (IVM) rate of bovine oocytes and on the formation of 17beta-estradiol in supernatants of mural granulosa cells (GC) cultures. These compounds induced dose-dependent oocyte maturation delay and chromatin abnormalities. Maturation of oocytes to metaphase II (M II) was inhibited in oocytes cultured in the presence of 30 µg/ml ZEA, alpha-zearalenol or zearalanone, with a significant increase in chromatin abnormalities occurring in the presence of ZEA ($P < 0.05$) and alpha-zearalenol ($P < 0.001$). In preliminary trials on 17beta-estradiol formation, at the same testing concentration, higher levels of 17beta-estradiol were found in the presence of alpha-zearalenol (mean value 1.6 ng/ml) with respect to ZEA and zearalanone (mean estradiol concentrations of 0.06 and 0.5 ng/ml, respectively). These data demonstrate a negative effect of ZEA and its derivatives on meiotic progression of bovine oocytes, possibly attributable to a toxic mechanism not related to the binding affinity of these compounds to oestrogen receptor

sites, and support previous observations that alpha-zearalenol acts as a stronger oestrogenic inducer than the original molecule (ZEA).
PT: Journal-article; Conference-paper
AN: 20023077358

TI: Statistically designed experiments in a tiered approach to screen mixtures of Fusarium mycotoxins for possible interactions.
AU: Tajima-O; Schoen-ED; Feron-VJ; Groten-JP
SO: Food-and-Chemical-Toxicology. 2002, 40: 5, 685-695; 36 ref.
LA: English
AB: This paper presents a test strategy to detect interactive effects between several mycotoxins using a DNA synthesis inhibition assay in mouse fibroblast L929 cells. The joint action of the Fusarium mycotoxins T-2 toxin (T2), deoxynivalenol (DON), nivalenol (NIV), zearalenone (ZEA) and fumonisin (FB1) was studied in a tiered approach. In the first stage, the mycotoxins were tested either jointly in a 5-compound mixture, or individually. At the highest dose level, the mixture showed a clear less than additive action of the mycotoxins, as compared to the effects of the 5 individual compounds, whereas at lower dose levels, the mycotoxins behaved additive. In the second stage, the non-additivity as established in the first experiment was further analysed with a central composite design to detect interactions between specific mycotoxins in the mixture. This experiment confirmed less than additivity for 5 of the mixes tested. However, it also revealed 4 significant synergistic interactions between mycotoxins. Finally, 2 interactions that were established in stage 2 were further studied in full factorial designs involving 2 mycotoxins. One of the interactions observed in the central composite design was retrieved, whereas the other 2-factor interaction was not. It is concluded that several classes of mycotoxins when present simultaneously in a mixture might show interaction. The effect of the mixture cannot be predicted solely on the basis of the effect of the individual compounds.
PT: Journal-article
AN: 20023083681

TI: Overview of fusarium ear blight in the UK -- effect of fungicide treatment on disease control and mycotoxin production.
AU: Jennings-P; Turner-JA; Nicholson-P
SO: The-BCPC-Conference:-Pests-and-diseases,-Volume-2.-Proceedings-of-an-international-conference-held-at-the-Brighton-Hilton-Metropole-Hotel,-Brighton,-UK,-13-16-November-2000. 2000, 707-712; 6 ref.
PB: British Crop Protection Council; Farnham; UK
LA: English
AB: A survey carried out in 1998 of harvested grain from 53 fields showing high levels of fusarium ear blight (FEB) infection indicated that the predominant species responsible was Microdochium nivale var. majus [Monographella nivalis]. High levels of Fusarium graminearum [Gibberella zeae], a species not commonly recorded in the UK, were also found. Trichothecene contamination of the grain samples was widespread with deoxynivalenol (DON) [vomitoxin] and nivalenol being the most commonly detected toxins. A strong positive correlation was established between the presence of these two toxins. Fungicide treatments on artificially inoculated field trials produced differential control of the FEB pathogens depending on the product applied. Several of the fungicides reduced the level of toxin-producing species and the subsequent levels of DON in the grain. However, there was

evidence to suggest that the application of some fungicides, given certain combinations of FEB pathogen on the ear, may precipitate an increase in the level of DON in the grain.
PT: Book-chapter; Conference-paper
IB: 1-901396-59-2
AN: 20003031772

TI: Post-harvest control of mycotoxigenic fungi in cereals.
AU: Sanchis-V; Magan-N
SO: The-BCPC-Conference:-Pests-and-diseases,-Volume-2.-Proceedings-of-an-international-conference-held-at-the-Brighton-Hilton-Metropole-Hotel,-Brighton,-UK,-13-16-November-2000. 2000, 713-720; 16 ref.
PB: British Crop Protection Council; Farnham; UK
LA: English
AB: Inefficient drying and storage of cereals can result in rapid mould spoilage, significant reduction in grain quality and mycotoxin contamination. To prevent post-harvest accumulation of mycotoxins in grain for human and animal consumption both environmental and chemical control measures have been examined. Effective drying regimes and storage at safe water availabilities and temperatures can give long periods of safe storage. Food grade preservatives have been the main means of trying to control growth of mycotoxigenic fungi and their toxins, such as Aspergillus flavus (aflatoxins), Penicillium verrucosum and Aspergillus ochraceus (ochratoxins), and more recently Fusarium spp (fumonisins, deoxynivalenol [vomitoxin], trichothecenes) in tropical cereals and nuts. However, low dosages of preservatives based on aliphatic acids can result in stimulation of growth and mycotoxin production. Propionate salts were demonstrated to control growth of F. moniliforme [Gibberella fujikuroi] and F. proliferatum, but have very little effect on fumonisin production in vitro or in situ on maize grain. Studies with antioxidants and natural essential oil-based compounds are showing potential for effective control of growth and mycotoxin production by such spoilage fungi post-harvest.
PT: Book-chapter; Conference-paper
IB: 1-901396-59-2
AN: 20003031774

TI: Deoxynivalenol and ochratoxin A in German wheat and changes of level in relation to storage parameters.
AU: Birzele-B; Prange-A; Kramer-J
SO: Food-Additives-and-Contaminants. 2000, 17: 12, 1027-1035; 41 ref.
LA: English
AB: The occurrence of the mycotoxins deoxynivalenol [vomitoxin] (DON) and ochratoxin A (OTA) in the winter wheat of 1997 and 1998 grown under organic farming conditions was investigated using ELISAs (R-Biopharm(R)) for quantification. The influence of delayed drying of the grain after harvest on the development of DON and OTA was determined in storage trials (moisture: 17% and 20%; temperature: 20°C; duration: four and six weeks). The Tox5 PCR assay was used both to detect Fusarium species with the potential to produce trichothecenes and as a measure of their relative DNA content during the storage trials. The intensity of the PCR signals was correlated with the DON concentration. Fusarium species were identified microscopically by standard methods. All the freshly harvested grain samples were contaminated with DON and showed further increases in the DON concentration during storage. OTA contamination was found in 14.3% of the 1997 samples and in 24.1% of the 1998 samples. OTA increased during storage trials of the 1997 samples but not in the 1998 samples.

PT: Journal-article
AN: 20013000154

TI: Need to determine the relative developmental risks of Fusarium mycotoxin dexoynivalenol (DON) and benomyl (BEN) in wheat.
AU: Hicks-LR; Brown-DR; Storch-RH; Bushway-RJ
SO: Human-and-Ecological-Risk-Assessment. 2000, 6: 2, 341-354; 33 ref.
LA: English
AB: The wheat supply is known to have levels of deoxynivalenol (DON) from fungal infections. The fungal infections can be suppressed with benomyl (BEN). Under certain exposure laboratory conditions DON and BEN are developmental toxins. Since use of BEN may result in concurrent dietary exposure to both compounds, evaluation of the relative developmental risks is needed. The dietary NOAELs for pup decreased body weight for DON and BEN are 0.375 mg/kg/day in mice and 5 mg/kg/day in rat, respectively. Human exposure to DON can be estimated from surveys of wheat grain and finished products which gave a mean DON concentration of 0.86 ppm. The tolerance level for BEN in grain is 0.2 ppm. Presence of DON and BEN in wheat at these concentrations would not impact wheat consumption. A modified margin of exposure (modMOE) was developed using "a" kg (food)/kg (body weight) as the constant for wheat consumption. The modMOE for DON is 28/a and that for BEN is 1667/a. Comparative relative risks can be expressed as the ratio of BEN risks to DON risks (60). Treatment with BEN at the most efficacious time decreased DON levels to 34% of controls, and decreased the comparative risk ratio from 60 to 18. The potential for fungicides to decrease mycotoxin health risks is important in the safety assessment for foodstuffs. This approach improves on current practices for food safety assessment by including the expected reductions in risks from naturally occurring mycotoxins in the regulatory analysis.
PT: Journal-article
AN: 20013046890

TI: Toxigenic strains of Fusarium moniliforme and Fusarium proliferatum isolated from dairy cattle feed produce fumonisins, moniliformin and a new C21H38N2O6 metabolite phytotoxic to Lemna minor L..
AU: Vesonder-RF; Wu-W; Weisleder-D; Gordon-SH; Krick-T; Xie-W; Abbas-HK; McAlpin-CE
SO: Journal-of-Natural-Toxins. 2000, 9: 2, 103-112; 13 ref.
LA: English
AB: Corn samples suspected of causing refusal-to-eat syndrome in dairy cattle were examined mycologically. Fusarium moniliforme [Gibberella fujikuroi] (14 isolates) and F. proliferatum (12 isolates) were the predominant fungi present. These isolates were tested for mycotoxin production on rice at 25°C. Each strain of F. moniliforme [Gibberella fujikuroi] produced fumonisin B1 (FB1: 378-15,600 ppm) and fumonisin B2 (FB2: 2-1050 ppm). Each strain of F. proliferatum produced moniliformin (45-16,000 ppm), FB1 (27-6140 ppm), and FB2 (5-1550 ppm). In addition, a new Fusarium metabolite of molecular composition C21H38N2O6 was produced by 10 of the F. moniliforme [Gibberella fujikuroi] isolates and 7 of the F. proliferatum isolates. The metabolite's 1H- and 13C-NMR, HRFAB/MS and IR spectra indicate an alpha amino acid. It is toxic to Lemna minor L. duckweed (LD50 100 µg/mL).
PT: Journal-article
AN: 20013047078

TI: Fusaria and fumonisins in maize from Ghana and their co-occurrence with aflatoxins.
AU: Kpodo-K; Thrane-U; Hald-B
SO: International-Journal-of-Food-Microbiology. 2000, 61: 2-3, 147-157; Many ref.
LA: English
AB: Fifteen maize samples from four markets and processing sites in Accra, Ghana were analysed for fumonisins B1, B2, and B3. All samples contained fumonisins. Total fumonisin levels for 14 samples ranged from 70 to 4222 µg kg-1. One sample of visibly mouldy kernels contained 52 670 µg kg-1 total fumonisins. Mycological examination of the samples showed Aspergillus spp. as the most dominant fungi (76.4%) followed by Penicillium spp. (19.9%). Fusarium formed 2.6% with Fusarium verticillioides [Gibberella moniliformis] as the predominant Fusarium species. Thirty-two Fusarium strains representing five species isolated from the maize samples were tested for the production of fumonisins in maize substrates. From 95% (21 of 22) of the Gibberella moniliformis strains tested, all three types of fumonisins were produced. Total fumonisin levels ranged from 127 to 11 052 µg g-1. Additional studies on maize samples from 15 processing sites in Accra revealed a co-occurrence of both fumonisins and aflatoxins in 53% (8 of 15) of the samples.
PT: Journal-article
AN: 20013050570

TI: Fungal contamination of rice from south Vietnam, mycotoxinogenesis of selected strains and residues in rice.
AU: Tran-Sy-Trung; Bailly-JD; Querin-A; Bars-P-le; Guerre-P; le-Bars-P
SO: Revue-de-Medecine-Veterinaire. 2001, 152: 7, 555-560; 29 ref.
LA: English
LS: French
AB: 25 samples of Vietnamese rice coming from the Mekong delta were analysed for fungal contamination. Ergosterol content measurement and total fungal load determination revealed that moulds contamination was quite weak. Identification of fungal species revealed that Aspergillus genus was the most important (43.75% of isolates) followed by Fusarium (21.8%) and Penicillium (10.9%). This analysis also revealed the presence of toxigenic strains such as Aspergillus flavus, A. ochraceus and Penicillium citrinum. These strains were tested for their toxinogenic potential on either YES liquid medium or on autoclaved rice. 80% of A. flavus strains were able to produce cyclopiazonic acid (levels up to 32.3 ppm), all strains of A. ochraceus synthesised ochratoxin A (one at 178 ppm) and the tested strain of P. citrinum was moderately toxigenic for citrinin. Moreover two rice samples were found contaminated with high level of ochratoxin A (21.3 and 26.2 ppb). Such contamination can probably be linked to unfavourable post harvest storage and climatic conditions.
PT: Journal-article
AN: 20013112833

TI: International interlaboratory study for the determination of the Fusarium mycotoxins zearalenone and deoxynivalenol in agricultural commodities.
AU: Josephs-RD; Schuhmacher-R; Krska-R
SO: Food-Additives-and-Contaminants. 2001, 18: 5, 417-430; 17 ref.
LA: English
AB: 28 laboratories from 12 different countries participated in an interlaboratory study for the determination of the Fusarium mycotoxin zearalenone (ZON) in maize and deoxynivalenol (DON) in maize and wheat employing their usual in-house methods. This study was conducted to obtain information about the state-of-the-art methods of ZON and DON analysis in cereals and to support a knowledge and experience exchange between the

participating laboratories in the field of mycotoxin analysis. Eight different sample types were distributed to the participants, 'blank' materials, spiked samples (102 µg/kg ZON in maize and 475 µg/kg DON in wheat) and naturally-contaminated maize and wheat. For the final separation and quantification, either gas chromatography (GC), high performance liquid chromatography (HPLC), thin layer chromatography (TLC) or enzyme linked immunosorbent assays (ELISA) were employed by the participating laboratories. Coefficients of variation (CV) between laboratory mean results (outliers rejected) ranged from 28%-41% for ZON and from 32%-38% for DON. These results are close to the laboratory CV criteria of 40% for DON and ZON at concentration levels of > 100 µg/kg established by the CEN in 1999. A good trueness was obtained for the wheat samples spiked at 475 µg/kg DON. However, a significant deviation at P=0.01 from the respective target value was observed for the maize samples spiked at 102 µg/kg ZON. The high CVs can be traced back to problems occurring in the determination of the concentration of the participants' own calibrant solutions. Additionally, the variability of the results is strongly influenced by the use of different final separation and quantification procedures.
PT: Journal-article
AN: 20013131804

TI: DNA adduct formation by Fusarium culture extracts: lack of role of fusarin C.
AU: Bever-RJ Jr.; Couch-LH; Sutherland-JB; Williams-AJ; Beger-RD; Churchwell-MI; Doerge-DR; Howard-PC
SO: Chemico-Biological-Interactions. 2000, 128: 2, 141-157; 36 ref.
LA: English
AB: Fusarium fungi have been shown to infect maize and other crops worldwide, and have a significant impact on human health through loss of crops or contamination of food with mycotoxins. Isolates of Fusarium fungi from an area of South Africa with high incidence of oesophageal cancer have been shown to induce oesophageal and liver cancer in rats. Several isolates of Fusarium fungi were grown on maize to determine if genotoxic products were produced. We report the incubation of methanol extracts of F. verticillioides cultures with DNA in the presence of rat liver fractions (S9) resulted in the formation of a unique DNA adduct that was detected by 32P-postlabelling. Fusarin C was purified from cultures of F. verticillioides RRC 415, and was not responsible for the formation of the DNA adduct. Treatment of the methanolic extracts with ultraviolet B radiation reduced the fusarin C content in the extract; however, this had no effect on the formation of the DNA adduct following incubation of the extract with DNA and S9. The unique DNA adduct was formed following the incubation of several F. verticillioides isolates from the USA and South Africa, while extracts of cultures of F. graminearium [Gibberella zeae] and F. sacchari isolates formed very little of the DNA adduct when incubated with DNA and S9. These data suggest that neither fusarin C nor any of its metabolites are responsible for formation of the DNA adduct, and that an unidentified compound is present in F. verticillioides cultures that forms a DNA adduct, and may be important in the aetiology of human oesophageal cancer.
PT: Journal-article
AN: 20013133152

TI: The state-of-the-art in the analysis of type-A and -B trichothecene mycotoxins in cereals.
AU: Krska-R; Baumgartner-S; Josephs-R
SO: Fresenius'-Journal-of-Analytical-Chemistry. 2001, 371: 3, 285-299; 124 ref.
LA: English

AB: The aim of this review is to describe the state-of-the-art in the analysis of A- and B-trichothecene mycotoxins in cereals and to support knowledge and experience exchange between laboratories in the field of Fusarium mycotoxin analysis. Current screening tests and quantitative methods for the most prevalent type-A and -B trichothecenes, HT-2 and T-2-toxin, and deoxynivalenol (DON) are reviewed. This includes the extraction and clean-up procedures and chromatographic methods (thin layer chromatography, HPLC, GC) applied and the immunochemical methods, especially ELISA, employed for the determination of these mycotoxins. Results from recent intercomparison studies of the determination of DON are also discussed. Experience gained during these intercomparisons clearly shows the need for further improvement in the determination of trichothecenes, to obtain more accurate and comparable results. This also indicates there is a strong need for the development of further certified reference materials (CRM) which would enable comparison of measurement results between different European laboratories for several A- and B-trichothecenes. For both A- and B-trichothecenes there is still a lack of simple and reliable screening methods enabling the rapid detection of these mycotoxins at low cost.
PT: Journal-article
AN: 20013152845

TI: A genetic approach to fumonisin biosynthesis in Fusarium proliferatum.
AU: Yamagishi-D; Visconti-A; Avantaggiato-G; Ouchi-S
SO: Bulletin-of-the-Institute-for-Comprehensive-Agricultural-Sciences,-Kinki-University. 2001, No.9, 13-28; 22 ref.
LA: English
AB: Fumonisins are structurally related mycotoxins produced by a number of morphologically related Fusarium species and some of them, especially fumonisin B1, are known to cause serious consequences in animal and human health when infested foods or feeds were eaten. In view of high contamination of food crops by fumonisin producing Fusarium species, measures to reduce mycotoxin production have been sought for lowering the risks of toxin intake. In this study, we aimed at characterizing fumonisin biosynthetic process in F. proliferatum by isolating toxin-deficient mutants among REMI-induced transformants. Two mutants were finally selected as candidates for analysing biosynthesis process of the toxin. They produced negligible amounts of fumonisin B1 together with an unknown compound which may be related closely to the biosynthetic pathway. These mutants could be used as competitors in field infection or in storage infestation.
PT: Journal-article
AN: 20013164961

TI: Fusarium headblight and deoxynivalenol.
AU: Mirocha-CJ
SO: Bulletin-of-the-Institute-for-Comprehensive-Agricultural-Sciences,-Kinki-University. 2001, No.9, 29-38; 39 ref.
LA: English
AB: This paper reviews the past and recent findings on Fusarium head blight and the mycotoxin commonly associated with the disease, deoxynivalenol [vomitoxin]. The plants affected (such as wheat and barley), economic importance, geographical distribution of the pathogens, biosynthesis of deoxynivalenol, pathogenesis and toxicity of deoxynivalenol and nivalenol are also mentioned.
PT: Journal-article
AN: 20013164964

TI: Problems associated with Fusarium mycotoxins in cereals.
AU: Visconti-A
SO: Bulletin-of-the-Institute-for-Comprehensive-Agricultural-Sciences,-Kinki-University. 2001, No.9, 39-55; 41 ref.
LA: English
AB: Fusarium species can produce over 100 secondary metabolites, some of which can unfavourably affect human and animal health. The most important Fusarium mycotoxins that can frequently occur at biologically significant concentrations in cereals are fumonisins, zearalenone and trichothecenes (deoxynivalenol [vomitoxin], nivalenol and T-2 toxin). These compounds have been implicated as the causative agents in a variety of animal diseases, such as leukoencephalomalacia, pulmonary oedema, infertility, diarrhoea, vomiting, anorexia, leukopenia, immunosuppression, skin and gastrointestinal irritation, haemorrhaging and have been associated with some human diseases. The IARC working group that determines carcinogenic risks to humans classified the toxins derived from F. moniliforme [Gibberella fujikuroi] (including fumonisins) as possibly carcinogenic to humans (Group 2B). Fusarium mycotoxin contamination of cereals can cause economic losses at all levels of food and feed production including crop and animal production, crop distribution and processing. Practical strategies to eliminate these mycotoxins from feed and food are required, although some progress is being made at the level of individual compound or group of compounds. Health risks associated with the consumption of cereal products contaminated with Fusarium mycotoxins are recognized worldwide and depend on the extent to which they are consumed in a diversified diet; several countries have recommended maximum tolerated levels for some of these mycotoxins. Further risk assessment and regulatory efforts should be established to ensure that Fusarium mycotoxin levels in foods and feeds are kept well below those which can constitute a potential hazard for human and animal health.
PT: Journal-article
AN: 20013164965

TI: Mating behavior, mycotoxin production, and vegetative compatibility of Gibberella fujikuroi species complex from sorghum in Korea.
AU: Lim-SunHee; Yun-SungHwan; Lee-YinWon; Lim-SH; Yun-SH; Lee-YW
SO: Plant-Pathology-Journal. 2001, 17: 5, 276-280; 31 ref.
LA: English
AB: Fusarium isolates of G. fujikuroi species complex were obtained from sorghum grown in five provinces (Gangwon, Gyeongbuk, Chungnam and Jeonnam) of Korea in 1996 and 1997. These isolates were characterized based on their mating behaviour, mycotoxin production and vegetative compatibility. Only three mating populations (A, D and F) were recovered from a total of 155 isolates examined. The relative frequency of the mating populations was significantly different: F was predominant (80%), while D and A were observed at low frequencies of 9% and 3%, respectively. Female fertile isolates were more common within F (44 out of 124) than D (2 out of 14), while none of the five A isolates were female fertile. The inbreeding effective population sizes (Ne) for mating type and male/hermaphrodite ratios in mating population F were 93% and 77% of the count, respectively. Isolates of mating populations A and D produced significant amounts of fumonisins, while F isolates produced none or only traces of fumonisin B1. In contrast, F isolates produced higher amounts of moniliformin (average of 3820 ppm) than A and D isolates (averages of 77 and 1819 ppm, respectively). Fifty-one isolates were tested for vegetative compatibility using nitrogen non-utilization mutants of each isolate, and 44 vegetative compatibility groups (VCGs) were identified. A single VC type (VC1) was found in all of the five A isolates examined. Six of the D isolates examined consisted of three VC types: two for VC2, two for VC3, and the rest

for VC4. All of the F isolates tested were incompatible in every combination and, thus, each constituted a unique VCG.
PT: Journal-article
AN: 20013165057

TI: Population genetic analyses of Gibberella fujikuroi isolates from maize in Korea.
AU: Park-SookYoung; Seo-JeongAh; Lee-YinWon; Lee-YongHwan; Park-SY; Seo-JA; Lee-YW; Lee-YH
SO: Plant-Pathology-Journal. 2001, 17: 5, 281-289; 42 ref.
LA: English
AB: We analysed 88 strains of G. fujikuroi (Anamorph: Fusarium section Liseola) from maize in Kangwon, Chungchong, Kyonggi, Kyongsang and Cheju, Korea for mating population, mating type, fumonisin production, vegetative compatibility and random amplified polymorphic DNA (RAPD) patterns. We found 50 strains that were MATA-2, 22 that were MATA-1, 1 that was MATD-1, and 15 that were not reproducibly fertile with any of the mating type testers. Of the 50 MATA-2, 15 were female fertile, while 10 of the 22 MATA-1 strains were female fertile. A total of 1138 nitrate non-utilizing (nit) mutants were recovered from a total of 88 strains. These strains were grouped into 39 vegetative compatibility groups (VCGs) by demonstrating heterokaryosis between nit mutants. A single maize ear could be infected by more than one VCG of F. moniliforme. RAPD analysis measured genetic diversity among 63 strains of F. moniliforme. Several VCGs were distinguished by RAPD fingerprinting patterns. Most strains produced significant levels of fumonisins. However, 6 MATA-2 strains from a single VCG produced higher levels of fumonisin B3 than that of fumonisin B1 or B2. From these data, we concluded that most Korean strains of F. moniliforme associated with maize belonged to mating population A and produced significant levels of fumonisins. Furthermore, RAPD analysis could differentiate strains associated with different VCGs.
PT: Journal-article
AN: 20013165058

TI: The occurrence of culmorin and hydroxy-culmorins in cereals.
AU: Ghebremeskel-M; Langseth-W
SO: Mycopathologia. 2001, 152: 2, 103-108; 28 ref.
LA: English
AB: 45 samples (collected from 1988-95) [Norway] of naturally contaminated grain, barley, wheat and oats, 3 samples of mixed feed, and 16 samples of grain artificially inoculated with Fusarium culmorum during the flowering stage were analysed for deoxynivalenol (DON), 3-acetyldeoxynivalenol (3-acetyl-DON), culmorin and hydroxy-culmorins. These compounds are secondary metabolites produced by the fungal species F. culmorum and F. graminearum. Acetonitrile-water extract of the samples was purified on a MycosepTMŁ225 column, derivatized using pentafluoropropionic anhydride (PFPA) and analysed by GC-MS. The amount of each of culmorin, 5-, 12-, 14 and 15-hydroxy-culmorin and one unknown hydroxy-culmorin were determined relative to the amount of DON plus 3-acetyl DON for each sample. The ratio between the total amount of culmorin compounds and the DON compounds ranged from 0.14 to 1.07 in the samples. There was a strong correlation between the amount of DON present in the grain and the amount of culmorin and hydroxy-culmorins present. The ratio of each of the culmorin compounds relative to the amount of DON compounds were in the same range in the grain artificially inoculated by F. culmorum as found in an earlier study for F. culmorum strains cultivated on rice, while the hydroxy-culmorin profile in the naturally contaminated grain was more similar to what was found for the F. graminearum cultures in

the same study. These results indicate that F. graminearum may be a relatively important source for DON in grain also in relatively cold areas.
PT: Journal-article
AN: 20013171650

TI: DNA damage in human fibroblasts exposed to fumonisin B1.
AU: Galvano-F; Russo-A; Cardile-V; Galvano-G; Vanella-A; Renis-M
SO: Food-and-Chemical-Toxicology. 2002, 40: 1, 25-31; 48 ref.
LA: English
AB: Fumonisins are mycotoxins produced by several Fusarium species (Fusarium verticilloides and F. proliferatum) that infest corn and other cereals. Fumonisin B1 (FB1), structurally resembling sphingoid bases, is an inhibitor of ceramide synthetase, a key enzyme involved in de novo sphingolipid biosynthesis and in the reacylation of free sphingoid bases derived from sphingolipid turnover. This inhibitory effect leads to accumulation of free sphinganine and sphingosine and subsequent induction of cell death. However, the downstream effectors activated by these sphingolipids in the cell death-signalling pathway are little known. The aim of this study was to evaluate in FB1-exposed human fibroblasts the involvement of oxygen free radicals and of some other biochemical pathways, caspase-3 activity, poly(ADP-ribose)polymerase (PARP) cleavage and DNA damage evaluated by comet assay. Our results indicate that FB1 treatment (48 and 72 h and 10, 50, 100 μM) does not affect cellular viability. Conversely, after 72 h of treatment, FB1 (50 and 100 μM) induced DNA damage, an enhancement of caspase-3-activity and cleavage of PARP compared to controls. In addition, FB1 increased the expression of HSP70 in a concentration and time-dependent manner. Our results indicate that DNA damage of apoptotic type in human fibroblasts is caused by exposure to FB1 at high concentrations and for a prolonged time and that the genotoxic potential of FB1 has probably been underestimated and should be reconsidered.
PT: Journal-article
AN: 20013176593

TI: Effects of azoxystrobin on mycotoxin production in a carbendazim-resistant strain of Fusarium sporotrichioides.
AU: D'-Mello-JPF; Macdonald-AMC; Rinna-R
SO: Phytoparasitica. 2001, 29: 5, 431-440; 11 ref.
LA: English
AB: Carbendazim-resistant (RS) and control (CS) strains of F. sporotrichioides, previously developed in our laboratory, were exposed to graded concentrations of azoxystrobin in broth media under shake-culture conditions for 2, 3, 4 and 8 days. Azoxystrobin concentrations were 0, 1, 10 and 100 mg l-1 broth, and cultures were incubated at a constant temperature of 25°C. Mycelial growth was significantly affected by strain ($P < 0.01$), azoxystrobin concentration ($P < 0.001$) and incubation time ($P < 0.001$). Combined results for the four incubation times showed that CS yielded higher mycelial mass than RS ($P < 0.01$) only in the absence of azoxystrobin. At fungicide additions of 1, 10 and 100 mg l-1, mycelial growth was reduced ($P < 0.001$) with minimum strain differences ($P > 0.05$) at all three doses of azoxystrobin. Significant ($P < 0.05$ or better) strain-fungicide interactions were recorded in trichothecene production following exposure to azoxystrobin. At 4 and 8 days of incubation, the addition of 10 mg azoxystrobin l-1 stimulated T-2 toxin synthesis ($P < 0.05$) only in RS cultures. In contrast, T-2 toxin enhancement in CS cultures occurred only on day 8 but at a lower level of azoxystrobin (1 mg l-1). Thus, the stimulation of T-2 toxin synthesis depended upon strain and azoxystrobin level. Production of diocetoxyscirpenol (DAS) was affected by a

more complex set of interactions. Overall means showed that, in comparison with initial values (on day 2 or 3), DAS output was significantly ($P < 0.05$) maximized on day 4 in RS cultures and on day 8 in CS. Marked strain effects were observed on exposure to the 10 mg l-1 level of azoxystrobin. At this level, DAS production was enhanced in RS only after 4 ($P < 0.01$) and 8 ($P < 0.05$) days of incubation, while in contrast, CS reduced DAS production. As with T-2 toxin, DAS production in CS was stimulated ($P < 0.05$ or better) only at low exposure levels of azoxystrobin. In the case of neosolaniol (NEO), however, the main effect of strain was significant ($P < 0.05$), with CS producing consistently more of the mycotoxin than RS on day 4 of the experiment. At this point, the NEO : T-2 toxin ratio was also higher in CS (0.63) than in RS (0.12), a feature reported by us previously. In conclusion, the present investigation has shown for the first time that the development of resistance to one fungicide can affect trichothecene production in F. sporotrichioides on exposure to a second fungicide. These results have been incorporated into a new classification scheme for fungicide efficacy which is also presented in this paper.
PT: Journal-article
AN: 20013177528

TI: Assessment of trichothecene contamination: chemical aspects and biological methodology.
AU: Widestrand-J
SO: Acta-Universitatis-Agriculturae-Sueciae -Agraria. 2001, No.274, 95 pp.; many ref.
PB: Sveriges Lantbruksuniversitet (Swedish University of Agricultural Sciences); Uppsala; Sweden
LA: English
AB: T-2 toxin (T-2), HT-2 toxin (HT-2), deoxynivalenol (DON) and nivalenol (NIV) are trichothecene mycotoxins that are frequently found in cereals. The trichothecenes are mainly produced by various strains of the Fusarium fungi, which infect cereals in the field. Due to their toxicity to humans and animals, the detection of trichothecenes in cereal samples is important. The aims of this thesis were to study chemical aspects of trichothecene standards (T-2, HT-2, DON and NIV) and to develop a biological methodology for detection of trichothecenes. Chemical characteristics of trichothecenes such as purity, molar absorptivity and stability were studied using nuclear magnetic resonance spectroscopy, liquid chromatography and spectrophotometry. The results presented in this thesis show that preparation of trichothecene calibrant solutions could be an important source of variation in trichothecene assessment using analytical methods. Uncertain purity and uncertain molar absorptivities of trichothecene standards make determination of the concentration of calibrant solutions difficult. Before new calibrants are used for calibration, the purity and concentration should be carefully checked using spectrophotometry, gas and liquid chromatography. Storage conditions may also be a source of variation for trichothecene calibrants. T-2, HT-2, DON and NIV were stable in acetonitrile for up to 24 months at 25°C while DON and NIV stored in ethyl acetate and as thin film decomposed progressively with increasing time and temperature. As a complement to chemical analysis, a rapid and simple cell culture-based bioassay was developed for screening of trichothecenes at nanogram/ml levels in cereals. It was concluded that inhibition of DNA synthesis as determined by reduced BrdU-incorporation was a suitable endpoint for evaluation of the cytotoxic effect of trichothecenes. Furthermore, it was shown that the MycoSepTM Ł225 column provides sufficient purification of cereal extracts for cytotoxicity screening of trichothecenes.
PT: Thesis
IB: 91-576-5808-0
AN: 20013181640

TI: Effect of the mycotoxin aurofusarin on the antioxidant composition and fatty acid profile of quail eggs.
AU: Dvorska-JE; Surai-PF; Speake-BK; Sparks-NHC
SO: British-Poultry-Science. 2001, 42: 5, 643-649; 32 ref.
LA: English
AB: The effect of the mycotoxin aurofusarin on the antioxidant composition and fatty acid profile of quail eggs was investigated. Thirty eight 45-day-old Japanese quails were divided into two groups (experimental and control, 15 females+4 males in each group) and were fed on a maize-soya diet balanced in all nutrients. The diet of the experimental quails was supplemented with aurofusarin at the level of 26.4 mg/kg feed in the form of Fusarium graminearum culture enriched with aurofusarin. At the beginning and after 2, 4 and 8 week supplementation periods, eggs were collected and analysed. After 8 weeks of supplementation, experimental quails were fed on unsupplemented diet during the next 4 weeks and eggs were collected after 2 and 4 weeks on such a diet and analysed. Aurofusarin caused a significant ($P < 0.05$) decrease in vitamins E, A, total carotenoid, lutein and zeaxanthin concentrations and significantly ($P < 0.05$) increased egg yolk susceptibility to lipid peroxidation. During two weeks on the diet without aurofusarin the levels of carotenoids in the egg yolk returned to the initial level, vitamins A and E returned to the initial level during 4 weeks on the same unsupplemented diet. Dietary supplementation with aurofusarin was associated with a significant ($P < 0.01$) decrease in the docosahexaenoic acid proportion in the phospholipid, cholesteryl ester and free fatty acid fractions of the egg yolk. At the same time the proportion of linoleic acid in the phospholipid, free fatty acid and triacylglycerol fractions significantly ($P < 0.05$) increased. It is concluded that mycotoxin aurofusarin is detrimental to the nutritional quality of eggs.
PT: Journal-article
AN: 20023000971

TI: Performance of modern sample preparation techniques in the analysis of Fusarium mycotoxins in cereals.
AU: Krska-R
SO: Journal-of-Chromatography,-A. 1998, 815: 1, 49-57; 34 ref.
LA: English
AB: The efficiency of modern sample preparation techniques are discussed and compared to well-established techniques with respect to the determination of zearalenone in corn and B-trichothecenes in wheat in the µg/kg range. This includes the use of immunoaffinity columns and of multifunctional Mycosep columns as well as the employment of supercritical fluid extraction for the trace analysis of these major Fusarium mycotoxins. In addition, the performance of new analytical methods was investigated in an interlaboratory comparison study only recently organized by our laboratory. From both the validation data, and from the results of the intercomparison study, the suitability and competitiveness of the described methods could be clearly demonstrated.
PT: Journal-article
AN: 20023006143

TI: Direct analysis of several Fusarium mycotoxins in cereals by capillary gas chromatography-mass spectrometry.
AU: Onji-Y; Aoki-Y; Tani-N; Umebayashi-K; Kitada-Y; Dohi-Y
SO: Journal-of-Chromatography,-A. 1998, 815: 1, 59-65; 9 ref.
LA: English

AB: A method for qualitative and quantitative analysis of Fusarium mycotoxins by gas chromatography-mass spectrometry (GC-MS) using cold on-column injection was improved. Eight typical mycotoxins, including deoxynivalenol (DON), 3-acetyldeoxynivalenol (3ADN), fusarenon-X (FX), diacetoxyscirpenol (DAS), 15-monoacetylscirpenol (15MAS), T-2 toxin (T-2), scirpentriol (SCT), and zearalenone (ZEA) were subjected to GC-MS without chemical derivatization by means of the on-column injection technique. Chromatographic separation of the toxins extracted from barley was achieved as a single peak, and the specific EI mass spectra of each toxin were obtained. The fatty acids in the extract that interfere with measurements of the toxins on the gas chromatogram were removed by precipitation as an insoluble metal soap with zinc acetate. Additional clean-up was accomplished using a Bond Elut Florisil cartridge. The quantitative detection limit in barley ranged from 0.1 to 0.5 µg/g. The average recoveries of 93.1% for DON, 3ADN, 15MAS, DAS, T-2 and ZEA, and 46.0% for FX and SCT added to barley at the level of 1 µg/g were obtained.
PT: Journal-article
AN: 20023006146

TI: Occurrence of beauvericin and enniatins in wheat affected by Fusarium avenaceum head blight.
AU: Logrieco-A; Rizzo-A; Ferracane-R; Ritieni-A
SO: Applied-and-Environmental-Microbiology. 2002, 68: 1, 82-85; 22 ref.
LA: English
AB: We evaluated Fusarium contamination and the levels of hexadepsipeptide mycotoxins in 13 wheat samples affected by head blight in Finland. F. avenaceum [Gibberella avenacea] was the dominant species (91%) isolated from all samples, but isolates of F. culmorum (4%), F. tricinctum (3%), and F. poae (2%) were also recovered. Beauvericin (0.64 to 3.5 µg/g) was detected in all 13 samples. Enniatin B (trace to 4.8 µg/g) was detected in 12 samples, enniatin B1 (trace to 1.9 µg/g) was detected in 8 samples, and enniatin A1 (trace to 6.9 µg/g) was detected in 10 samples. Ten of the 13 strains of F. avenaceum and 2 strains of F. poae and F. tricinctum produced beauvericin when cultured on rice (trace to 70, 9.4, and 33 µg/g, respectively). All strains also produced enniatins (trace to 2700 µg/g). This is the first report on the natural co-occurrence of beauvericin and enniatins in wheat infected predominantly by F. avenaceum.
PT: Journal-article
AN: 20023008593

TI: Effects of mycotoxin contaminated wheat and detoxifying agent on the performance of pigs and digestibility of nutrients.
AU: Danicke-S; Valenta-H; Doll-S; Flachowsky-G; Schubert-R (ed.); Flachowsky-G (ed.); Jahreis-G (ed.); Bitsch-R
SO: Vitamine-und-Zusatzstoffe-in-der-Ernahrung-von-Mensch-und-Tier.-8.-Symposium,-26.-und-27.-September,-2001,-Jena-Thuringen,-Germany. 2001, 473-476; 2 ref.
PB: Friedrich-Schiller-Universitat; Jena; Germany
LA: English
LS: German
AB: Deoxynivalenol (DON) contaminated wheat was incorporated in the grower (40%) and finisher (45%) diets and tested in the presence or absence of a detoxifying agent (Mycofix Plus, MP). Uncontaminated control diets were tested in the same manner. The 4 resulting diets were fed to 12 growing pigs grouped accordingly. 2 pigs were kept in one pen and fed unpelleted feed and water ad libitum. A balanced experiment was performed during the growing phase to evaluate the nutritive value of the diets. DON contaminated diets decreased

the daily weight gain by 10% and the feed intake. An increase in feed to gain ratio was also observed. The balance experiment, however, yielded a different picture. Feeding of the contaminated diets resulted in a significant improvement in the digestibility of organic matter. Moreover, MP significantly decreased fat digestibility. The discrepancy between the results of the growing experiment and balance study was mainly due to the feeding regimen applied. Feed was offered ad libitum in the growing experiment while feed intake was restricted during the balance period. Thus, the negative effects of DON were primarily due to the depression in voluntary feed intake. It is concluded that grower and finisher diets containing 3.2 and 3.6 mg DON, respectively, significantly depressed the performance of growing pigs.
PT: Book-chapter; Conference-paper
IB: 3-933140-51-X
AN: 20023025559

TI: Toxicity of fumonisin from Fusarium verticillioides culture material and moniliformin from Fusarium fujikuroi culture material when fed singly and in combination to growing barrows.
AU: Harvey-RB; Edrington-TS; Kubena-LF; Rottinghaus-GE; Turk-JR; Genovese-KJ; Ziprin-RL; Nisbet-DJ
SO: Journal-of-Food-Protection. 2002, 65: 2, 373-377; 38 ref.
LA: English
AB: The effects of fumonisin B1 (FB1) from Fusarium verticillioides culture material and moniliformin from Fusarium fujikuroi culture material on growing barrows were evaluated. Four groups of six barrows (three replicates of two each; mean body weight 11.1 kg) were fed diets containing 0 mg FB1 and 0 mg moniliformin/kg feed (control), 100 mg FB1/kg feed, 100 mg moniliformin/kg feed, and 100 mg FB1 plus 100 mg moniliformin/kg feed. Barrows were fed these diets for 28 days. Liveweight gain, feed efficiency, serum biochemical analytes, and haematological values were adversely affected by the FB1 and the FB1-plus-moniliformin diets. The moniliformin diet decreased liveweight gain. Two barrows in the moniliformin diet group and two barrows in the FB1-plus-moniliformin diet group died. All deaths occurred during the first 6 days of the study. Mild to moderate lesions were observed microscopically in heart and lung tissues of the groups fed moniliformin and FB1 plus moniliformin and in liver tissues of groups fed FB1 and FB1 plus moniliformin. Except for the acute mortality associated with the two diets containing moniliformin, clinical disease induced by the combined feeding of these two mycotoxins appears to be additive or less than additive and due primarily to the toxic expression of FB1.
PT: Journal-article
AN: 20023028418

TI: Quantification of trichothecene-producing Fusarium species in harvested grain by competitive PCR to determine efficacies of fungicides against fusarium head blight of winter wheat.
AU: Edwards-SG; Pirgozliev-SR; Hare-MC; Jenkinson-P
SO: Applied-and-Environmental-Microbiology. 2001, 67: 4, 1575-1580; 48 ref.
LA: English
AB: We developed a PCR-based assay to quantify trichothecene-producing Fusarium based on primers derived from the trichodiene synthase gene (Tri5). The primers were tested against a range of fusarium head blight (FHB) (also known as scab) pathogens, i.e. F. culmorum, F. graminearum [Gibberella zeae], F. poae, F. crookwellense, F. sporotrichioides, F. sambucinum [G. pulicaris], F. avenaceum [G. avenacea], F. tricinctum and Microdochium nivale (Monographella nivalis), and found to amplify specifically a 260-bp product from 25

isolates belonging to six trichothecene-producing Fusarium species. Amounts of the trichothecene-producing Fusarium and the trichothecene mycotoxin deoxynivalenol (DON) in harvested winter wheat grain from a field trial (Shropshire, UK; 1998-99) designed to test the efficacies of the fungicides metconazole, azoxystrobin, and tebuconazole to control FHB were quantified. No correlation was found between FHB severity and DON in harvested grain, but a good correlation existed between the amount of trichothecene-producing Fusarium and DON present within grain. Azoxystrobin did not affect levels of trichothecene-producing Fusarium compared with those of untreated controls. Metconazole and tebuconazole significantly reduced the amount of trichothecene-producing Fusarium in harvested grain. We hypothesize that the fungicides affected the relationship between FHB severity and the amount of DON in harvested grain by altering the proportion of trichothecene-producing Fusarium within the FHB disease complex and not by altering the rate of DON production. The Tri5 quantitative PCR assay will aid research directed towards reducing amounts of trichothecene mycotoxins in food and animal feed.
PT: Journal-article
AN: 20023031889

TI: Regulation of fumonisin B1 biosynthesis and conidiation in Fusarium verticillioides by a cyclin-like (C-type) gene, FCC1.
AU: Shim-WB; Woloshuk-CP
SO: Applied-and-Environmental-Microbiology. 2001, 67: 4, 1607-1612; 36 ref.
LA: English
AB: Fumonisins are a group of mycotoxins produced in maize kernels by the plant-pathogenic fungus Fusarium verticillioides. A mutant of the fungus, FT536, carrying a disrupted gene named FCC1 (for Fusarium cyclin C1) resulting in altered fumonisin B1 biosynthesis was generated. FCC1 contains an open reading frame of 1018 bp, with one intron, and encodes a putative 319-amino-acid polypeptide. This protein is similar to UME3 (also called SRB11 or SSN8), a cyclin C of Saccharomyces cerevisiae, and contains three conserved motifs: a cyclin box, a PEST-rich region, and a destruction box. Also similar to the case for C-type cyclins, FCC1 was constitutively expressed during growth. When strain FT536 was grown on maize kernels or on defined minimal medium at pH 6, conidiation was reduced and FUM5, the polyketide synthase gene involved in fumonisin B1 biosynthesis, was not expressed. However, when the mutant was grown on a defined minimal medium at pH 3, conidiation was restored, and the blocks in expression of FUM5 and fumonisin B1 production were suppressed. Our data suggest that FCC1 plays an important role in signal transduction regulating secondary metabolism (fumonisin biosynthesis) and fungal development (conidiation) in F. verticillioides.
PT: Journal-article
AN: 20023031894

TI: Determination of the Fusarium mycotoxins, fusaproliferin and beauvericin by high-performance liquid chromatography-electrospray ionization mass spectrometry.
AU: Sewram-V; Nieuwoudt-TW; Marasas-WFO; Shephard-GS; Ritieni-A
SO: Journal-of-Chromatography,-A. 1999, 858: 2, 175-185; 31 ref.
LA: English
AB: A method is described using LC-MS for the detection of the mycotoxins fusaproliferin (FUS) and beauvericin (BEA) in cultures of Fusarium subglutinans [Gibberella fujikuroi var. subglutinans] and in naturally contaminated maize. Protonated molecular ion signals for FUS and BEA were observed at m/z 445 and m/z 784, respectively. Collision induced dissociation of the readily dehydrated protonated molecular ion of the sesterterpene FUS (m/z 427) led to

the loss of another water molecule (m/z 409) and acetic acid (m/z 385), while the cyclic lactone trimer BEA fragmented to yield the protonated dimer (m/z 523) and monomer (m/z 262), respectively. Detection of FUS was best performed in the MS-MS mode while BEA displayed a stronger signal in the MS mode. The on-column instrumental detection limits for pure FUS and BEA were found to be 2 ng and 20 pg (S/N=2) while those in naturally contaminated maize were 1 µg/kg and 0.5 µg/kg, respectively. Five South African strains of F. subglutinans were analysed following methanol extraction of which 4 produced FUS at levels between 330 mg/kg and 2630 mg/kg while only 3 produced BEA at levels between 140 mg/kg and 700 mg/kg. Application of this method to naturally contaminated maize samples from the Transkei region of South Africa showed FUS at levels of 8.8-39.6 µg/kg and BEA at 7.6-238.8 µg/kg.
PT: Journal-article
AN: 20023033197

TI: Fumonisin B1 from the fungus Fusarium moniliforme causes contact toxicity in plants: evidence from studies with biosynthetically labeled toxin.
AU: Abbas-HK; Smeda-RJ; Gerwick-BC; Shier-WT
SO: Journal-of-Natural-Toxins. 2000, 9: 1, 85-100; 31 ref.
LA: English
AB: Fumonisin B1 isolated from F. moniliforme [Gibberella fujikuroi] caused necrosis, growth inhibition and death in Datura stramonium, Solanum nigrum and tomatoes. Biosynthetically-labelled toxin was shown to have full biological activity and it induced phytotoxic symptoms identical to unlabelled material.
PT: Journal-article
AN: 20003005908

TI: Fumonisin B1-nonproducing strains of Fusarium verticillioides cause maize (Zea mays) ear infection and ear rot.
AU: Desjardins-AE; Plattner-RD
SO: Journal-of-Agricultural-and-Food-Chemistry. 2000, 48: 11, 5773-5780; 29 ref.
LA: English
AB: Fumonisin levels in maize kernels infected by strains of F. verticillioides were determined by HPLC. All 3 non-fumonisin B1-producing strains were able to infect maize ears indicating that fumonisin production is not required for F. verticillioides to cause ear infection and ear rot of maize.
PT: Journal-article
AN: 20003030063

TI: Interactions between environmental stress and fungicides affect growth and mycotoxin production by Fusarium culmorum isolates from wheat grain.
AU: Hope-RJ; Colleate-A; Baxter-ES; Magan-N
SO: The-BCPC-Conference:-Pests-and-diseases,-Volume-3.-Proceedings-of-an-international-conference-held-at-the-Brighton-Hilton-Metropole-Hotel,-Brighton,-UK,-13-16-November-2000. 2000, 889-894; 10 ref.
PB: British Crop Protection Council; Farnham; UK
LA: English
AB: Water availability (0.995-0.97 aw), temperature (15, 25°C) and fungicide (azoxystrobin, propiconazole and epoxiconazole, 0.50 ppm) interactions affected growth, interspecific interactions and deoxynivalenol (DON) [vomitoxon] production by F. culmorum isolates from different regions of Europe. Significant intra- and inter-isolate differences were found in

growth rates of isolates from the UK, Norway, Sweden and Italy. Regardless of aw or temperature, azoxystrobin was ineffective. Fungicides applied to wheat grain were less effective than in vitro at the same concentrations. DON production significantly increased at reduced aw (0.97) in the presence of fungicides.
PT: Book-chapter; Conference-paper
IB: 1-901396-60-6
AN: 20003031834

TI: Occurence of the three important Fusarium-toxins deoxynivalenol, nivalenol and zearalenone in grains in central Europe and effects in farm animals.
AU: Drochner-W; Lauber-U
SO: Ubersichtsreferat (Review), Kurzfassungen der Originalmitteilungen (Abstracts) und workshop- Beitrage der 55. Tagung vom 06. - 08.03.2001 in Gottingen. Proceedings-of-the-Society-of-Nutrition-Physiology. 2001, 10: 163-168; 38 ref.
LA: English
AB: Deoxynivalenol (DON), nivalenol (NIV) and zearalenone (ZEA) are the most frequently recorded Fusarium mycotoxins in grain in central Europe. Studies in Germany revealed that DON has the highest frequency of occurrence in wheat, oats and barley, with a contamination rate of 30-90%. The toxic principles, clinical and practical observations, and suggestions for further work are discussed, with a brief review of the effects of DON in pigs.
PT: Journal-article; Conference-paper
IB: 3-7690-4094-5
AN: 20013061557

TI: Further survey of the occurrence of Fusarium toxins in wheat grown in southwest Germany.
AU: Muller-HM; Reimann-J; Schumacher-U; Schwadorf-K
SO: Archives-of-Animal-Nutrition. 2001, 54: 2, 173-182; 23 ref.
LA: English
AB: A total of 53, 54, 57, 52 and 60 wheat samples for feed use were collected randomly after the 1989, 1990, 1991, 1992 and 1993 crops, respectively, from farms in an area of southwest Germany. Deoxynivalenol (DON) [vomitoxin], 3- and 15-acetyldeoxynivalenol (3-, 15-ADON), nivalenol (NIV), HT-2 toxin (HT-2), T-2 toxin (T-2), diacetoxyscirpenol (DAS), and fusarenon-X (FUS-X) were determined by gas chromatography, combined with mass selective detection (GC-MS); zearalenone (ZEA), alpha- and beta-zearalenol (alpha-, beta-ZOL) were determined by HPLC. DON was the major toxin, with incidences at 77 to 93% and mean contents at 167 to 735 µg/kg. In contrast, incidences of ZEA, 3-ADON, NIV, HT-2, and T-2 were at 13 to 37%, 10 to 44%, 15 to 67%, 0 to 11%, and 0 to 12%, respectively, with mean contents in positive samples between 2 and 73 µg/kg, except for 948 µg/kg 3-ADON in samples from 1993. 15-ADON and FUS-X were assayed in samples from 1991, 1992 and 1993. 15-ADON was found in 0 to 11% of samples, at mean levels _ 17 µ/kg; DAS, alpha- and beta-ZOL, and FUS-X were not detected in any sample. Over the years, incidences and levels of toxins remained constant, with most differences (decreased or increased) between years being slight and insignificant. The risk for livestock due to DON, HT-2 and ZEA was estimated based on maximum tolerated levels recommended for these toxins in some countries.
PT: Journal-article
AN: 20013100676

TI: Incidence of Fusarium mycotoxins (T-2, DAS, DON and FB1) in corn and corn-based products and thermostability of fumonisin B1.
AU: El-Sayed-AMAA; Soher-EA; Sahab-AF
SO: Annals-of-Agricultural-Science-Cairo. 2001, 46: 1, 273-285; 31 ref.
LA: English
LS: Arabic
AB: A total of 57 samples of corn and corn based products collected from various districts of Egypt were analyzed for Fusarium mycotoxins (T-2, DAS, DON and FB1) and aflatoxins. Fumonisin B1 (FB1) was detected in about 80, 53.85, 33.3 and 28.57% of yellow corn, corn meal, white corn and popcorn samples, respectively. The level of FB1 ranged from 10 to 780 µg/kg. T-2 and DAS were detected in 5 and 10% of yellow corn samples, respectively. While, DON was detected in white corn and popcorn samples at level of 28.8 and 10.1 µg/kg respectively. Starch samples were found to be free from Fusarium mycotoxins. Baking balady bread at 450°C/min reduced FB1 to 72.4% while baking Franco bread at 250°C/20min reduced FB1 to 57.4%. Boiling of macaroni and cooking of corn in water completely remove FB1 from contaminated samples. On the other side, corn flakes samples were found to be contaminated with aflatoxins B1 and G1 at levels ranging from 6 to 10 ppm, whereas 2.9% of samples were contaminated with aflatoxin B1 > 35 ppm and G1 > 16 ppm.
PT: Journal-article
AN: 20013112325

TI: Trichothecene and moniliformin production by Fusarium species from Western Canadian wheat.
AU: Abramson-D; Clear-RM; Gaba-D; Smith-DM; Patrick-SK; Saydak-D
SO: Journal-of-Food-Protection. 2001, 64: 8, 1220-1225; 39 ref.
LA: English
AB: Fusarium graminearum, Fusarium culmorum and Fusarium avenaceum, isolated from Fusarium-damaged wheat harvested in western Canada, were cultured and evaluated for mycotoxin production. Extracts of the culture media were assayed for trichothecenes by gas chromatography-mass spectrometry and for moniliformin by liquid chromatography. Deoxynivalenol (DON) was found in 28 of 42 isolates of F. graminearum and 42 of 42 isolates of F. culmorum at levels ranging from 0.5 to 25.0 µg/g. 15-AcetylDON was found in 28 of 42 isolates of F. graminearum at levels ranging from 1.0 to 7.1 µg/g. 3-AcetylDON was found in 41 of 42 isolates of F. culmorum at levels ranging from 0.8 to 13.0 µg/g. Several other trichothecenes were assayed but not detected in the culture medium. Moniliformin was present in 40 of 42 isolates of F. avenaceum at levels ranging from 1.3 to 138.1 µg/g, but was not present in any of the isolates of F. graminearum or F. culmorum.
PT: Journal-article
AN: 20013114866

TI: Fumonisins B1 and B2 in black tea and medicinal plants.
AU: Martins-ML; Martins-HM; Bernardo-F
SO: Journal-of-Food-Protection. 2001, 64: 8, 1268-1270; 20 ref.
LA: English
AB: Fumonisins are mycotoxins produced by Fusarium monoliforme that are prevalent in cereals and other agricultural products. These mycotoxins have been pointed to as a natural cause of equine leukoencephalomalacia, porcine pulmonary oedema and human oesophageal cancer. A total of 87 samples, 18 black tea samples and 69 samples of four different medicinal plants (chamomile, leaves of the orange tree, leaves and flowers of the linden tree, and corn silk), for infusions preparations were acquired from supermarkets in Lisbon, Portugal. The

samples were analysed for the incidence and levels of fumonisin B1 (FB1) and fumonisin B2 (FB2) by high-performance liquid chromatography. The detection limit was 20 µg/kg for both FB1 and FB2. FB1 was detected in 55 (65.5%) of the 87 samples. The highest number of positive samples was found in black tea (88.8%), with levels ranging from 80 to 280 µg/kg. Relative to the medicinal plants, the leaves of the orange tree had higher concentrations of FB1 (range, 350 to 700 µg/kg) followed by leaves and flowers of the linden tree (range, 20 to 200 µg/kg). The samples of corn silk and chamomile had less contamination of FB1, with concentrations ranging from 50 to 150 µg/kg and 20 to 70 µg/kg, respectively. None of the samples tested had contamination of FB2. This is the first report of the natural occurrence of fumonisins in black tea and medicinal plants in Portugal. We reinforce the necessity to implement risk management measures for safety control of this kind of product.
PT: Journal-article
AN: 20013114900

TI: Fumonisin B1 metabolism by bovine liver microsomes.
AU: Spotti-M; Pompa-G; Caloni-F
SO: Veterinary-Research-Communications. 2001, 25: 6, 511-516; 27 ref.
LA: English
AB: Only limited and contrasting information is available about the metabolic fate, in cattle, of fumonisin B1, a mycotoxin produced by the fungus Fusarium moniliforme [Gibberella fujikuroi]. This study was carried out to evaluate the hepatic metabolism of fumonisin B1 by bovine liver microsomes. Liver samples from two healthy cattle were collected and used in the experiment. No biodegradation or metabolization of the mycotoxin by liver microsomes was detectable after incubating fumonisin B1 with bovine microsomes in the presence of a regenerating system for 1 h. No aminopolyol 1, aminopolyol 2 or aminopentol, metabolites of fumonisin B1, were detected in any of the incubated samples. The tolerance of ruminants to fumonisin B1 is apparently not dependent on its detoxification in the rumen.
PT: Journal-article
AN: 20013118138

TI: Toxicity of culture material of Fusarium verticillioides strain MRC 826 to nonhuman primates.
AU: Gelderblom-WCA; Seier-JV; Snijman-PW; Schalkwyk-DJ-van; Shephard-GS; Marasas-WFO; van-Schalkwyk-DJ; Allaben-WT (ed.); Bucher-JR (ed.); Howard-PC
SO: International conference on the toxicology of fumonisins, Arlington, Virginia, USA, 28-30 June 1999. Environmental-Health-Perspectives. 2001, 109: Supplement 2, 267-276; 23 ref.
LA: English
AB: We conducted a chronic feeding study in vervet monkeys (Cercopithecus aethiops) over 13.5 years. The experimental design consisted of two dietary treatment groups, each including males and females, fed varying levels of culture material of Fusarium verticillioides (Sacc.) Nirenberg (= F. moniliforme [Gibberella fujikuroi] Sheldon) strain MRC 826 mixed into their daily food ration. Two females were included as treatment controls. We conducted blood chemical analyses bimonthly and recorded all clinical signs during the course of the experiment. We took liver biopsies at various stages during the initial phase of the experiment. Several monkeys were terminated in extremis during the experiment. Detailed feed intake profiles were determined 5 years after the experiment began, and the fumonisin B (FB) mycotoxin content of the feed was determined during the final stages of the experiment. The apparent FB consumption patterns were related to changes observed in the biochemical parameters in the blood and urine, including the liver function enzymes and creatinine clearance as well as differential blood counts and sphingolipid levels in the serum and urine.

An apparent no-effect threshold for kidney and liver damage is estimated to be between 0.11 and 0.18 mg FB/kg body weight (bw)/day, which corresponds to a feed contamination level of between 8.21 and 13.25 mg FB/kg bw diet. Apart from the effects on the liver and kidney, a wide variety of parameters, including cholesterol and creatine kinase, were also adversely affected. Several blood parameters, including white and red blood cells, also significantly decreased in the treated animals. The serum sphinganine level and the sphingosine/sphinganine ratio, monitored toward the end of the experiment, significantly increased in both the low-dose and high-dose animals. The present study provides important information about the diversity of lesions induced by culture material of F. verticillioides in vervet monkeys and the dosage levels of fumonisins to be used in long-term studies in nonhuman primates.
PT: Journal-article; Conference-paper
AN: 20013119164

TI: Prospects for reducing fumonisin contamination of maize through genetic modification.
AU: Duvick-J; Allaben-WT (ed.); Bucher-JR (ed.); Howard-PC
SO: International conference on the toxicology of fumonisins, Arlington, Virginia, USA, 28-30 June 1999. Environmental-Health-Perspectives. 2001, 109: Supplement 2, 337-342; 92 ref.
LA: English
AB: Current and proposed genetic and molecular approaches that can potentially lead to reduced exposure to fumonisin from maize (e.g. antifungal proteins, engineered secondary metabolites, transgene-enhanced defence pathways, gene-for-gene resistance to Fusarium, modifying mycotoxin catabolic pathways, detoxification of mycotoxins) are described.
PT: Journal-article; Conference-paper
AN: 20013119200

TI: Reaction of fumonisin with glucose prevents promotion of hepatocarcinogenesis in female F344/N rats while maintaining normal hepatic sphinganine/sphingosine ratios.
AU: Liu-HongJun; Lu-Yun; Haynes-JS; Cunnick-JE; Murphy-P; Hendrich-S; Liu-HJ; Lu-Y
SO: Journal-of-Agricultural-and-Food-Chemistry. 2001, 49: 8, 4113-4121; 50 ref.
LA: English
AB: The reaction of the primary amine of fumonisin B1 (FB1) with glucose was hypothesized to detoxify this mycotoxin. Eighty 10-day-old female F344/N rats were injected intraperitoneally with diethylnitrosamine (DEN; 15 mg/kg BW). At 4 weeks of age, the weaned rats were randomly assigned to one of four treatment groups with 20 rats each. At 9 weeks of age, four rats from each treatment group were killed. At 12 weeks, another five rats from each group were killed. At 20 weeks of age, the remaining rats were killed. In comparison with the rats fed basal diet or FB1-glucose (containing 25 ppm of FB1), rats fed 8 ppm (residual amount of free FB1 in the FB1-glucose mixture) or 25 ppm of FB1 had greater alanine aminotransferase activity at 9 and 20 weeks of age ($P < 0.001$), greater endogenous hepatic prostaglandin E2 production at 20 weeks of age ($P < 0.05$), and significantly lower plasma cholesterol at 20 weeks of age ($P < 0.01$). Placental glutathione S-transferase (PGST)-positive and gamma-glutamyltransferase (GGT)-positive altered hepatic foci (AHF) occurred only in rats fed 25 ppm of FB1 at 20 weeks of age. Hepatic natural killer (NK) cell activities were similar among the four groups, but the percentage of total liver-associated mononuclear cells exhibiting the NKR-P1bright marker was significantly greater in rats fed FB1-glucose, FB1 (8 ppm) and FB1 (25 ppm) than in control rats at 9 weeks of age, and FB1-glucose-treated rats had significantly lower NKR-P1bright cells as a percentage of total liver-associated mononuclear cells than rats fed 25 ppm of FB1 at 20 weeks of age ($P < 0.05$). PGST- or GGT-positive AHF were not detected in any treatment group at 9 or 12 weeks of

age. At 20 weeks of age, half of the rats fed 25 ppm of FB1 had PGST- and GGT-positive AHF. The sphinganine (Sa) concentration and the Sa/sphingosine (So) ratio were significantly greater in the rats fed 25 ppm of FB1 diet as compared with the control groups at 12 or 20 weeks of age, respectively. Therefore, modifying FB1 with glucose appears to prevent FB1-induced hepatotoxicity and the promotion of hepatocarcinogenesis. The Sa/So ratio was not the most sensitive biomarker of FB1 toxicity.
PT: Journal-article
AN: 20013122485

TI: Aflatoxins and fumonisins in corn from the high-incidence area for human hepatocellular carcinoma in Guangxi, China.
AU: Li-FengQin; Yoshizawa-T; Kawamura-O; Luo-XueYun; Li-YuWei; Li-FQ; Luo-XY; Li-YW
SO: Journal-of-Agricultural-and-Food-Chemistry. 2001, 49: 8, 4122-4126; 27 ref.
LA: English
AB: A comparative study on the natural occurrence of aflatoxins and Fusarium toxins was conducted with corn samples from high- and low-incidence areas for human primary hepatocellular carcinoma (PHC) in Guangxi, China. In samples from the high-risk area, aflatoxin B1 was the predominant toxin detected in terms of quantity and frequency, with its concentration ranging between 9 and 2496 μg/kg and an 85% incidence of contamination. Among the samples, 13 (76%) exceeded the Chinese regulation of 20 μg/kg for aflatoxin B1 in corn and corn-based products intended for human consumption. Significant differences in aflatoxin B1, B2 and G1, and total aflatoxin concentrations in corn between the areas were found ($P < 0.05$). The average daily intake of aflatoxin B1 from corn in the high-risk area was 184.1 μg, and the probable daily intake is estimated to be 3.68 μg/kg BW/day, 3.20 times the TD50 in rats. Corn samples from both areas were simultaneously contaminated with fumonisins B1, B2 and B3. Aflatoxin B1 may play an important role in the development of PHC in Guangxi.
PT: Journal-article
AN: 20013122487

TI: Trichothecenes, ochratoxin A and zearalenone contamination and Fusarium infection in Finnish cereal samples in 1998.
AU: Eskola-M; Parikka-P; Rizzo-A
SO: Food-Additives-and-Contaminants. 2001, 18: 8, 707-718; many ref.
LA: English
AB: The occurrences and concentrations of trichothecenes, ochratoxin A and zearalenone in Finnish cereal samples are presented in this study. Furthermore, infections by moulds, especially Fusarium contamination of grains in the same samples, are reported. A total of 68 cereal samples, including 43 rye, 4 wheat, 15 barley and 6 oats samples, were collected after a cool and very rainy growing season in 1998. A gas chromatography combined with a mass spectrometric detector was used for determination of 7 different trichothecenes. A high performance liquid chromatography with a fluorescence detector was used for ochratoxin A and zearalenone determination. For the identification of moulds, the grain samples were incubated and the moulds were isolated and identified by microscopy. The analytical methods were validated for mycotoxin analysis and they were found to be adequately reliable and sensitive. Heavy rainfalls in the summer and autumn of 1998 caused abundant Fusarium mould infection in Finnish cereals, particularly in rye. Fusarium avenaceum [Gibberella avenacea] was the most common Fusarium species found in cereals. However, the mycotoxin concentrations were very low and only deoxynivalenol [vomitoxin], nivalenol and HT-2 toxin

were detected. Deoxynivalenol was detected in 54 samples in the concentration range of 5-111 µg/kg. Nivalenol and HT-2 toxin were detected in 3 and 2 samples, respectively, in the concentration range of 10-20 µg/kg.
PT: Journal-article
AN: 20013131178

TI: Evaluation of fumonisin-aflatoxin co-occurrence in Brazilian corn hybrids by ELISA.
AU: Ono-EYS; Ono-MA; Funo-FY; Medina-AE; Oliveira-TCRM; Kawamura-O; Ueno-Y; Hirooka-EY
SO: Food-Additives-and-Contaminants. 2001, 18: 8, 719-729; 45 ref.
LA: English
AB: The natural co-occurrence of fumonisins and aflatoxins was investigated in freshly harvested corn [maize] kernels (150 samples, 62 hybrids), acquired from the Central-Southern (27 samples, 21 hybrids), Central-Western (86 samples, 51 hybrids) and Northern (37 samples, 18 hybrids) regions of the State of Parana, Brazil, during 1994-95, using enzyme-linked immunosorbent assay (ELISA). Fumonisins were detected in 147 (98%) samples at a concentration range of 0.096 to 22.6 µg/g, while aflatoxins were detected in 17 (11.3%). All the aflatoxin-positive samples (range 38.0-460.0 ng/g) came from the Central-Western region and were co-contaminated with fumonisins. Fumonisin contamination was higher in corn from the Northern (9.85 µg/g) and Central-Western regions (5.08 µg/g), when compared with the Central-Southern region (1.14 µg/g). The overall evaluation detected 62% samples with fumonisin levels _5.0 µg/g. Regional differences affected fumonisin levels in the same hybrid, regardless of Fusarium count and moisture content, suggesting interference from climatic conditions in addition to the local predominance of toxigenic strains of the Fusarium biotype.
PT: Journal-article
AN: 20013131180

TI: Fusarium species (section Liseola) and its mycotoxins in maize harvested in northern Argentina.
AU: Torres-AM; Reynoso-MM; Rojo-FG; Ramirez-ML; Chulze-SN
SO: Food-Additives-and-Contaminants. 2001, 18: 9, 836-843; 37 ref.
LA: English
AB: Maize and maize products harvested in small fields and stored by farmers in northern Argentina were assayed for Fusarium and fumonisin and beauvericin contamination. Fumonisins were present in six of the 18 samples. The levels of fumonisins ranged from 603 to 1888 ng/kg. Fumonisin B3 (FB3) and beauvericin were not detected in the samples evaluated. Fusarium subglutinans was one of the most prevalent species isolated. Twenty-five strains of F. subglutinans isolated from maize kernels and belonging to Gibberella fujikuroi mating population E were beauvericin-producers in culture. Seven of these strains also produced moniliformin. This is the first report on beauvericin-production by maize isolates of F. subglutinans from Argentina.
PT: Journal-article
AN: 20013131198

TI: Preliminary evaluation of fumonisins by the Nordic countries and occurrence of fumonisins (FB1 and FB2) in corn-based foods on the Danish market.
AU: Petersen-A; Thorup-I; Scott-PM
SO: Fumonisins risk assessment workshop, Maryland, USA, 10-12 January 2000. Food-Additives-and-Contaminants. 2001, 18: 3, 221-226; 12 ref.

LA: English
AB: Experts from the Nordic countries (Denmark, Norway, Sweden, Finland and Iceland) have carried out an evaluation of fumonisins. The working group members concluded that, at that time point, it was not possible to carry out a complete risk assessment. However, it was recommended that the human daily intake of fumonisins should be < 1 µg/kg bw/day. Subsequently, the presence of the Fusarium mycotoxins fumonisin B1 and B2 (FB1 and FB2) in corn-based food on the Danish retail market has been determined. A total of 70 samples were analysed and 37% contained FB1 and 21% contained FB2. No fumonisins were found in sweet corn (canned or frozen), corn-on-the-cob, corn starch or gruel powder for babies. FB1 was found in about half of the corn flakes, corn snack and popcorn (not popped) samples, whereas FB2 was seen to a lesser extent. Both FB1 and FB2 were found in 75% or more of the corn flour, tacos and polenta samples. In general, the content of FB1 was in the range of 1-1000 µ/kg and the content of FB2 was in the range of 4-250 µg/kg. Corn-based foods are consumed in rather low amounts and irregularly among the Danish population and therefore it is not meaningful to calculate an average daily fumonisin intake. An estimate for an 'eater' shows that the intake of fumonisins will not exceed 0.4 µg/kg bw/day.
PT: Journal-article; Conference-paper
AN: 20013131259

TI: The occurrence of type A and B trichothecenes in Lithuanian cereals.
AU: Keblys-M; Flaoyen-A; Langseth-W
SO: Acta-Agriculturae-Scandinavica.-Section-B,-Soil-and-Plant-Science. 2000, 50: 3-4, 155-160; 25 ref.
LA: English
AB: Samples of winter wheat (n = 84), winter rye (n = 46) and barley (n = 29) were collected from the larger family farms and from partnerships in Lithuania just after the 1998 harvest. The number of samples collected from each region was proportional to the amount of grain produced in it. The levels of the Fusarium toxins, deoxynivalenol (DON), 3-acetyl-DON, 15-acetyl-DON, nivalenol (NIV), fusarenon-X (4-acetyl-NIV), T-2 toxin, HT-2 toxin, 4,5-diacetoxyscirpenol (DAS), 1,5-monoacetoxyscirpenol (MAS) and scirpentriol in the grain were determined by gas chromatography with mass-selective detection. DON was most often detected in the wheat and rye samples, and NIV in the barley samples. The concentrations were lower than those causing acute or chronic toxic effects in livestock or humans. No fusarenon-X or 15-acetyl-DON was detected, and only small amounts of other trichothecenes were present. Climatic conditions in Lithuania in the summer of 1998 were slightly cooler and wetter than the average for the 1992-96 but were close to the norm. Because the samples analysed were representative of grain produced for the market in seasons with normal weather, trichothecene contamination of grain from large family farms and partnerships would not be expected to be a problem in most years.
PT: Journal-article
AN: 20013132498

TI: Fungal infection and mycotoxin contamination of maize in the humid forest and the Western Highlands of Cameroon.
AU: Ngoko-Z; Marasas-WFO; Rheeder-JP; Shephard-GS; Wingfield-MJ; Cardwell-KF
SO: Phytoparasitica. 2001, 29: 4, 352-360; 36 ref.
LA: English
AB: Fungal incidence and mycotoxin contamination of farm-stored maize were assessed and compared in grain samples from three villages each in two agroecological zones over time. Maize samples were collected at 2 and 4 months after stocking from 72 farmers' stores in

1996 and 1997 in the Humid Forest (HF) and Western Highlands (WHL) of Cameroon. Mycological assays of these samples revealed several fungal species. Nigrospora spp. were the most prevalent fungi in HF (32%) and WHL (30%) in 1996, Fusarium verticillioides (22%) and F. graminearum [Gibberella zeae] (27%) were also isolated from these samples. In the WHL in 1996, no significant difference in fungal incidence was found among villages for samples collected 2 months after harvest, but at 4 months incidence was significantly higher ($P < 0.05$). In 1997 the levels of fungal contamination were lower than in 1996. The incidence of Aspergillus spp. was low in general, ranging from 0.0 to 5.9% infected kernels. Analysis with thin layer chromatography detected low levels of aflatoxins in a few samples. F. verticillioides mycotoxin fumonisin B1 (300-26,000 ng/g) and F. graminearum metabolites deoxynivalenol [vomitoxin] (< 100-1300 ng/g) and zearalenone (< 50-110 ng/g) were determined by means of polyclonal antibody competitive direct enzyme-linked immunosorbent assay. A significant correlation ($r=0.72$; $P=0.0001$) was found between the incidence of F. graminearum and the contamination with deoxynivalenol. Storage time (2 vs 4 months after stocking) had a significant positive effect ($r=0.39$; $P=0.013$) on the level of fumonisin B1. This is the first report of the natural occurrence of these mycotoxins in maize in Cameroon.
PT: Journal-article
AN: 20013137635

TI: Stability of the Fusarium mycotoxins nivalenol, deoxynivalenol and zearalenone in ground maize under typical cooking environments.
AU: Lauren-DR; Smith-WA
SO: Food-Additives-and-Contaminants. 2001, 18: 11, 1011-1016; 13 ref.
LA: English
AB: The effects of moisture, pH and heat on the stability of nivalenol (NIV), deoxynivalenol (DON) and zearalenone (ZEN) present as natural contaminants of ground maize were measured for different periods. Standard solution tests were also performed to measure pH, salt and temperature effects on NIV and DON. The solution tests showed NIV and DON to be relatively stable in buffer solutions over the pH range 1-10. Quite harsh conditions (pH 12, high salt concentration, 80°C, prolonged exposure) were needed to give substantial breakdown. In the ground maize substrate, these toxins were further stabilized relative to the solution tests. NIV and DON were both reduced (range 60-100%) by treatment with aqueous bicarbonate solution at 10, 20 or 50% of the ground maize dry weight, and subsequent heating at 80 or 110°C for 2 and 12 days. There was no measurable reduction at lower test temperatures (20, 40°C). NIV (but not DON) also showed some reduction following addition of water and heating at 80 or 110°C for 12 days. ZEN content was not reduced even by 12 days of heating at 110°C after treatment with a sodium bicarbonate solution.
PT: Journal-article
AN: 20013139063

TI: Toxigenic potential of Fusarium culmorum strains isolated from French wheat.
AU: Bakan-B; Pinson-L; Cahagnier-B; Melcion-D; Semon-E; Richard-Molard-D
SO: Food-Additives-and-Contaminants. 2001, 18: 11, 998-1003; 37 ref.
LA: English
AB: Sixty F. culmorum strains were isolated from wheat grains collected from different wheat-growing areas in France and from different cultivars. The isolates were grown on autoclaved wheat grain to assess their ability to produce trichothecenes and zearalenone. Fungal biomass was evaluated through the ergosterol grain content. All the isolates produced zearalenone (0.39-1660 mg kg-1). Thirty-five of the 60 F. culmorum produced nivalenol

(0.11-11.7 mg kg-1), 12 of 60 produced fusarenone X (0.05-8.42 mg kg-1), five of 60 produced 15-acetyldeoxynivalenol (0.48-27.7 mg kg-1), 13 of 60 produced 3-acetyldeoxynivalenol (0.07-21.0 mg kg-1) and 24 of 60 produced deoxynivalenol (0.92-51.9 mg kg-1). According to the results, the distribution of the different chemotypes as well as the high and the low mycotoxin-producing Fusarium strains could not be associated to geographical origin.
PT: Journal-article
AN: 20013139071

TI: Investigation of a new cereal fungicide for the control of Fusarium and Fusarium toxins.
AU: Greenfield-JE; Rossall-S; Gooding-MJ (ed.); Barton-SA (ed.); Smith-GP
SO: Wheat Quality. Meeting organized by the Association of Applied Biologists, Reading, UK, 17-19 September 2001. Aspects-of-Applied-Biology. 2001, No.64, 237-238.
LA: English
AB: A study was conducted to evaluate a new cereal fungicide, Charisma, for its ability to control F. culmorum and evaluate its impact on wheat (cv. Cadenza) grain quality and viability and the levels of F. culmorum toxins produced compared with other established fungicides. At growth stages (GS) 39 and 59 plants were sprayed, with field rate solutions of one of four fungicides: 1 litre tebuconazole/ha, 1 litre azoxystrobin/ha, 500 g carbendazim/ha and 1.5 litre flusilazole and famoxate/ha (all in 200 litres of water). At early or mid-anthesis, plants were inoculated with F. culmorum at 105 conidia/ml. In plants treated with sterile distilled water and F. culmorum, visual infection levels were between 72.5 and 83.75% of the spike. Charisma reduced visual infection by 67.0-80.3%. Results for other fungicides were 34.0-67.0, 9.6-35.8 and 37.0-44.0%, for tebuconazole, azoxystrobin and carbendazim, respectively. For thousand grain weight, there was a large difference in all cases between the plants inoculated and not inoculated with F. culmorum. Even with fungicide application, F. culmorum had a devastating effect on seed weight. In all cases, seed weights were at least half that of their non-inoculated counterparts. Seed infection of Charisma-treated plants ranged from 45 to 75%, depending on inoculation and fungicide application times. Results for other fungicides were: 40-70, 90-100 and 75-90% for tebuconazole, azoxystrobin and carbendazim, respectively. Control seeds were 90-100% infected. In seed viability tests, controls had 33-43% seed germination rates. Treatment with Charisma resulted in 63.5-83.5% seed germination. Results for other fungicides were 58.0-61.5, 58.5-66.5 and 60.0-68.5% for tebuconazole, azoxystrobin and carbendazim, respectively. Treatment with Charisma resulted in the lowest deoxynivalenol [vomitoxin] levels at early and mid-anthesis.
PT: Journal-article; Conference-paper
AN: 20013146170

TI: Impact of trichothecenes on Fusarium head blight [Fusarium graminearum] development in spring wheat (Triticum aestivum).
AU: Eudes-F; Comeau-A; Rioux-S; Collin-J
SO: Canadian-Journal-of-Plant-Pathology. 2001, 23: 3, 318-322; 37 ref.
LA: English
LS: French
AB: Fusarium head blight pathogens (Fusarium spp.) produce trichothecenes that have been demonstrated to play a role in the pathogenesis. To test the impact of trichothecenes on a broad range of genotypes, 18 spring wheat (Triticum aestivum) lines were inoculated with two F. graminearum [Gibberella zeae] strains, the genetically modified GzT40 strain, which could not produce trichothecene, and the wild parental Gz3639 strain. During 3 weeks of

observation, the two fungal strains showed extreme differences in aggressiveness in all but three of wheat genotypes tested. While the GzT40 mutant did not spread into the rachis, the wild-type strain quickly spread in the spike. This work confirms earlier findings that trichothecenes are a principal determinant of F. graminearum aggressiveness on most spring wheat cultivars. Therefore, trichothecenes may serve as a useful screening tool in programmes breeding for resistance to Fusarium head blight of wheat.
PT: Journal-article
AN: 20013152136

TI: Effects of T-2 toxin, zeolite and mycosorb on antioxidant systems of growing quail.
AU: Dvorska-JE; Surai-PF
SO: Asian-Australasian-Journal-of-Animal-Sciences. 2001, 14: 12, 1752-1757; 42 ref.
LA: English
AB: The present study was conducted to assess the dietary effect of T-2 toxin on the antioxidant systems of the liver in growing quail and to comparatively evaluate the protective properties of 2 different mycotoxin-adsorbent additives, Mycosorb and zeolite, in preventing inhibition of the antioxidant system. Four groups of 4-days-old quail were formed with 20 birds in each group. The birds were maintained on the floor for the course of the study. The 3 treatment diets consisted of the basal diet with T-2 toxin added in the form of Fusarium sporotrichioides culture (8.1 mg/kg feed), T-2 toxin (8.1 mg/kg) plus zeolite (30 g/kg feed), and T-2 toxin (8.1 mg/kg) plus Mycosorb (1 g/kg feed). After 30 days of feeding (34-days-old) all birds were sacrificed and liver samples for biochemical analyses were collected from 5 quail in each of the 4 groups. Antioxidant concentrations were evaluated by HPLC-based methods. Inclusion of T-2 toxin in the quail diet was associated with a significant ($P < 0.05$) decrease in concentrations of all forms of antioxidants studied, including alpha- and gamma-tocopherols, ascorbic acid, retinol and retinyl esters. At the same time, liver susceptibility to lipid peroxidation significantly ($P < 0.05$) increased. Inclusion of zeolite in the quail diet at the level of 3% was ineffective in preventing antioxidant depletion in the liver by mycotoxicosis. In contrast, Mycosorb in the diet at a 0.1% level was able to significantly inhibit liver antioxidant depletion and as a result decreased lipid peroxidation in the liver. Concentrations of all forms of antioxidants studied were significantly higher in the livers of the quails fed the basal and T-2 toxin/Mycosorb combination in comparison to birds fed the basal with T-2 toxin alone.
PT: Journal-article
AN: 20013156488

TI: Mycoflora and mycotoxins natural occurrence in corn from Entre Rios province, Argentina.
AU: Pacin-AM; Broggi-LE; Resnik-SL; Gonzalez-HHL
SO: Mycotoxin-Research. 2001, 17: 1, 31-38; 17 ref.
LA: English
AB: Corn samples were collected in 1999 from 3 departments of Entre Rios province, Argentina, and were surveyed for mould contamination and natural occurrence of Fusarium mycotoxins, ochratoxin A and aflatoxins. Fusarium verticillioides was the most prevalent fungal species recorded at all departments. Zearalenone, deoxynivalenol and ochratoxin A were not found in any samples. Only one of the 52 corn samples analysed was contaminated with aflatoxin B1 (17 µg/kg). Fumonisin B1 was found in 58% of samples (range of positive samples: 47-3347 µg/kg), fumonisin B2 in 33.0% (range of positive samples: 23-537 µg/kg) and fumonisin B3 in 25.0% (range of positive samples: 24-287 µg/kg). This is the first report

on the natural occurrence of mycotoxins in corn from Entre Rios province. Levels of fumonisins were lower than detected in other Argentinian provinces.
PT: Journal-article
AN: 20013161240

TI: Toxicity of moniliformin from Fusarium fujikuroi culture material to growing barrows.
AU: Harvey-RB; Edrington-TS; Kubena-LF; Rottinghaus-GE; Turk-JR; Genovese-KJ; Nisbet-DJ
SO: Journal-of-Food-Protection. 2001, 64: 11, 1780-1784; 25 ref.
LA: English
AB: The effects of monliliformin (M)-contaminated diets from F. fujikuroi culture material on growing barrows were evaluated in two studies. In the first study, 6 barrows (3 replicates of 2 each, mean body weight=17.8 kg) per group (4 groups; total of 24 barrows) were fed with diets containing 0 (control); 25; 50; or 100 mg M/kg feed for 28 days. In the second study, the same experimental design and number of barrows (mean body weight=15.3 kg) were used and fed with 0 (control); 50; 100; or 200 mg M/kg feed. Diets of 100 or 200 mg M/kg feed reduced body weight, body weight gain, and feed consumption. Serum biochemical analytes were affected by by 100 to 200 mg M/kg feed. Haematological values were affected by 50, 100, and 200 mg M/kg feed. In the first study, one barrow in the 100 mg M/kg treated group died. In the second study, also one barrow died in the 100 mg M/kg treated group, and 5 from the 200 mg M/kg treated group. Relative heart weight was increased in the 200 mg M/kg treated barrows. However, tissues from organs collected from treatment groups were histologically unimpressive. The most consistent sign of M toxicity in barrows appeared to be death induced within 2 to 5 days by 100 to 200 mg M/kg of feed.
PT: Journal-article
AN: 20013169281

TI: Determination of deoxynivalenol in wheat-based breakfast cereals marketed in Portugal.
AU: Martins-ML; Martins-HM
SO: Journal-of-Food-Protection. 2001, 64: 11, 1848-1850; 17 ref.
LA: English
AB: Deoxynivalenol (DON), also known as vomitoxin, belongs to a group of closely related secondary fungal metabolites, the trichothecenes, and is produced predominantly by several species of the genus Fusarium, especially Fusarium graminearum. The present study was carried out to evaluate the natural occurrence of DON in different kinds of wheat-based breakfast cereals widely consumed by the population. A total of 88 commercially available samples of wheat-based breakfast cereals were randomly collected from different supermarkets in Lisbon, Portugal. The samples were analysed using immunoaffinity column, and DON was quantified by liquid chromatography. Detection limit was 100 µg/kg. Average recovery of DON was 80%. Of the 88 analysed samples, 72.8% contained levels of DON between 103 and 6040 µg/kg, with mean level of 754 µg/kg, and 24 samples (27.2%) were not contaminated (< 100 µg/kg). These results indicate an incidence of this mycotoxin in these products. Moreover, monitoring for the prevention of moulds and mycotoxins is suggested. This is the first report in Portugal of natural contamination with DON in wheat-based breakfast cereals.
PT: Journal-article
AN: 20013169305

TI: Resistance to Fusarium head blight and deoxynivalenol accumulation in wheat.
AU: Bai-GH; Plattner-R; Desjardins-A; Kolb-F

SO: Plant-Breeding. 2001, 120: 1, 1-6; 14 ref.
LA: English
AB: Fusarium head blight (FHB), caused by F. graminearum (telomorph = Gibberella zeae), is an important wheat disease worldwide. Production of deoxynivalenol [vomitoxin] (DON) by F. graminearum in infected wheat grain is detrimental to livestock and is also a safety concern in human foods. An international collection of 116 wheat lines was evaluated for FHB resistance and concentration of DON in grain. Plants were inoculated with mixed isolates of F. graminearum in the greenhouse by injecting conidia into a single spikelet of each spike and in the field by scattering F. graminearum-infected wheat kernels on the soil surface. FHB symptoms were evaluated by visual inspection in both the greenhouse and field, and DON was analysed by HPLC. Significant differences in FHB ratings and DON levels were observed among cultivars. In the greenhouse test, visual symptoms varied from no spread of FHB from the inoculated spikelet to spread throughout the spike, and DON levels ranged from trace levels to 283 mg/kg. In the field test, DON ranged from 2.8 to 52 mg/kg. The greenhouse test identified 16 wheat lines from various origins that accumulated less than 2 mg/kg DON. These lines may be useful as sources for breeding wheat cultivars with lower DON levels. Correlation coefficients were significant between FHB symptom ratings, seed quality traits, and DON levels. Thus, the percentage of scabbed spikelets and kernels can be generally used to predict DON levels in harvested wheat grain. In breeding programmes, selection for plants having few scabbed spikelets and scabbed kernels is most likely to result in low DON levels.
PT: Journal-article
AN: 20013048851

TI: An enzyme linked immunoassay for the determination of deoxynivalenol in wheat based on chicken egg yolk antibodies.
AU: Schneider-L; Pichler-H; Krska-R
SO: Fresenius'-Journal-of-Analytical-Chemistry. 2000, 367: 1, 98-100; 25 ref.
LA: English
AB: An indirect competitive enzyme linked immunoassay (ELISA) for the detection of the Fusarium mycotoxin deoxynivalenol [vomitoxin] (DON) in wheat was developed. Instead of the more common antibody isolation from mammal serum, DON specific antibodies were, for the first time, isolated from the eggs of previously immunized hens. The limit of detection was 2 µg/litre for standard curves and spiked wheat extracts. Recoveries for naturally contaminated samples (200-525 µg/kg) were between 80 and 125% compared with GC-ECD data. Concentrations for naturally contaminated samples were chosen with regard to current Austrian guidelines concerning DON levels in produce intended for human consumption, recommending a maximum of 500 µg DON/kg.
PT: Journal-article
AN: 20013060113

TI: Effects of genotype and genotype-environment interaction on deoxynivalenol accumulation and resistance to Fusarium head blight in rye, triticale, and wheat.
AU: Miedaner-T; Reinbrecht-C; Lauber-U; Schollenberger-M; Geiger-HH
SO: Plant-Breeding. 2001, 120: 2, 97-105; 35 ref.
LA: English
AB: Fusarium culmorum is one of the most important Fusarium species causing head blight infections in wheat, rye, and triticale. It is known as a potent mycotoxin producer with deoxynivalenol (DON), 3-acetyl deoxynivalenol (3-ADON), and nivalenol (NIV) being the most prevalent toxins. In this study, the effect of winter cereal species, host genotype, and

environment on DON accumulation and Fusarium head blight (FHB) was analysed by inoculating 12 rye, eight wheat, and six triticale genotypes of different resistance levels with a DON-producing isolate at three locations in 2 years (six environments). Seven resistance traits were assessed, including head blight rating and relative plot yield. In addition, ergosterol, DON and 3-ADON contents in the grain were determined. A growth chamber experiment with an artificially synchronized flowering date was also conducted with a subset of two rye, wheat and triticale genotypes. Although rye genotypes were, on average, affected by Fusarium infections much the same as wheat genotypes, wheat accumulated twice as much DON as rye. Triticale was least affected and the grain contained slightly more DON than rye. In the growth chamber experiment, wheat and rye again showed similar head blight ratings, but rye had a somewhat lower relative head weight and a DON content nine times lower than wheat (3.9 vs. 35.3 mg/kg). Triticale was least susceptible with a five times lower DON content than wheat. Significant (P = 0.01) genotypic variation for DON accumulation existed in wheat and rye. The differences between and within cereal species in the field experiments were highly influenced by environment for resistance traits and mycotoxin contents. Nevertheless, mean mycotoxin content of the grain could not be associated with general weather conditions in the individual environments. Strong genotype environment interactions were found for all cereal species. This was mainly due to three wheat varieties and one rye genotype being environmentally extremely unstable. The more resistant entries, however, showed a higher environmental stability of FHB resistance and tolerance to DON accumulation. Correlations between resistance traits and DON content were high in wheat (P = 0.01), with the most resistant varieties also accumulating less DON, but with variability in rye. In conclusion, the medium to large genotypic variation in wheat and rye offers good possibilities for reducing DON content in the grains by resistance selection. Large confounding effects caused by the environment will require multiple locations and/or years to evaluate FHB resistance and mycotoxin accumulation.
PT: Journal-article
AN: 20013067234

TI: Apoptosis induction by the satratoxins and other trichothecene mycotoxins: relationship to ERK, p38 MAPK, and SAPK/JNK activation.
AU: Yang-GiHyeok; Jarvis-BB; Chung-YongJoo; Pestka-JJ; Yang-GH; Chung-YJ
SO: Toxicology-and-Applied-Pharmacology. 2000, 164: 2, 149-160; 70 ref.
LA: English
AB: A study was conducted to assess the induction of cytotoxicity and apoptosis by the satratoxins and other representative trichothecenes (sesquiterpenoid metabolites produced by Fusarium, Stachybotrys and other moulds) in 2 myeloid models, RAW 264.7 murine macrophage cells and U937 human leukaemic cells. These effects were further related to activation of mitogen-activated protein kinases (MAPKs). Low doses of satratoxins and other highly toxic trichothecenes activated not only stress-activated protein kinase/c-Jun N-terminal kinase and p39 MAPK but also extracellular signal-regulated protein kinase. Trichothecene-mediated cytotoxicity and apoptosis correlated closely with inducibility of all MAPKs suggesting the likely involvement of these pathways in thichothecene-induced apoptosis. MAPKs may play important and contributory roles to the multiple toxic manifestations associated with the satratoxins and other trichothecenes.
PT: Journal-article
AN: 20013075687

TI: Association of Fusarium mycotoxicosis with failure in applying an induction of parturition program with PGF2alpha and oxytocin in sows.

AU: Alexopoulos-C
SO: Theriogenology. 2001, 55: 8, 1745-1757; 25 ref.
LA: English
AB: This trial was conducted in a farrow-to-finish pig unit (n=220) between November 1999 and February 2000 (Greece). Since November 1998 an induction-of-parturition programme was applied in gilts and sows with PGF2alpha (2 mL Dinolytic, im) 113 d post service, followed by oxytocin (1 mL Intertocine-S, im) 24 h later. This program resulted in a high proportion of animals farrowing within the working hours of the day. At mid-December 1999 splay-legs and oedematous swelling and reddening of the vulva started to be observed in newborn piglets. A concurrent decline of parameters related to parturition also was noticed. Mycotoxicological analyses of the feeds revealed a co-occurring contamination with deoxynivalenol and zearalenone. For a 4 week period, sows were divided into 2 groups: (a) an induction-of-parturition and (b) a non-induction-of-parturition group. Significant differences were found between the 2 groups relating to prevalence of dystocia (< 0.05) and pregnancy duration (< 0.05). Moreover, it was found that prevalence of splay-legs and swelling of the vulva were highly correlated (< 0.05) with reduction of percentage of sows farrowing within the working day and increase of pre-weaning mortality. It is concluded that such an induction-of-parturition program should be avoided during a Fusarium mycotoxicosis.
PT: Journal-article
AN: 20013079112

TI: Study of toxigenic moulds and mycotoxins in poultry feeds.
AU: Benkerroum-S; Tantaoui-Elaraki-A
SO: Revue-de-Medecine-Veterinaire. 2001, 152: 4, 335-342; 44 ref.
LA: English
LS: French
AB: Seventy samples of poultry feeds including "starting" mixed feed, maize, barley, wheat bran, fish-meal and soja, sunflower and colza cakes were analysed for fungal contamination. Their water activity was also determined. The total fungal loads in analysed samples varied around 105 cfu/g, while the activity of water varied from 0.73 to 0.83. The identification of 196 isolates of moulds revealed that, they belong to 10 different genera; Penicillium and Aspergillus were the most represented (35.7% and 20.4%, respectively). The other genera identified were Fusarium, Alternaria, Trichoderma, Cladosporium, Verticillium, Mucor, Rhizopus and Ulocladium. Three out of ten A. flavus Link isolates, were able to produce aflatoxin B1 on rice. One isolate among 4 A. ochraceus Wilhelm and 2 among 14 P. verrucosum produced ochratoxin A on wheat. The toxigenesis of these strains was lower on the substrates from which they had been isolated from, than on reference substrate, and even on soja. None of the 15 Fusarium roseum isolates produced zearalenone on maize. Cultured on a rich medium containing Yeast Extract and Sucrose, 40 isolates including Penicillium, Aspergillus, Fusarium and Alternaria representatives were able to produce toxic metabolites as revealed by routine biological tests. One of "starting" mixed food was found to be contaminated with 1.4 ppb aflatoxin B1.
PT: Journal-article
AN: 20013079403

TI: Trichothecene content of rye and wheat genotypes inoculated with a deoxynivalenol- and a nivalenol-producing isolate of Fusarium culmorum.
AU: Miedaner-T; Reinbrecht-C
SO: Journal-of-Phytopathology. 2001, 149: 5, 245-251; 24 ref.
LA: English

AB: Head blight caused by Fusarium culmorum may lead to yield reduction and the contamination of cereal grain with the mycotoxins deoxynivalenol (DON), 3-acetyl deoxynivalenol (3-ADON), nivalenol (NIV), fusarenone-X (FUS), and others. In this study, the covariation between DON and NIV accumulation of 12 rye and 8 wheat genotypes that differed in resistance were analysed by inoculating them with a DON-and a NIV-producing isolate, respectively, in three locations in southwest Germany, in 1996. The resistance traits head blight rating and plot yield relative to the uninoculated plots of the same genotype were assessed and the contents of DON, 3-ADON, NIV, and FUS in the grain were analysed by gas chromatography with mass spectrometry. The NIV-producing isolate was significantly (P=0.05) less aggressive and led to a considerably lower mean NIV content in the grain compared with the aggressiveness and mean DON content of the DON-producing isolate (19.5 mg NIV/kg grain versus 48.4 mg DON/kg). Wheat and rye genotypes significantly differed in their DON and NIV accumulation. All genotypes reacted in a similar manner to both chemotypes of F. culmorum for the resistance traits and the respective mycotoxin contents with the exception of one wheat variety, that caused a change in rank order for mycotoxin content. In conclusion, resistance to head blight and tolerance to mycotoxin accumulation seems to be most likely the same for DON- and NIV-producing isolates of F. culmorum.
PT: Journal-article
AN: 20013081625

TI: Differential control of head blight pathogens of wheat by fungicides and consequences for mycotoxin contamination of grain.
AU: Simpson-DR; Weston-GE; Turner-JA; Jennings-P; Nicholson-P
SO: European-Journal-of-Plant-Pathology. 2001, 107: 4, 421-431; 46 ref.
LA: English
AB: Fusarium head blight of wheat is caused by a disease complex comprised of toxigenic pathogens, predominantly Fusarium spp., and a non-toxigenic pathogen Microdochium nivale [Monographella nivalis], which causes symptoms visually indistinguishable from Fusarium and is often included as a causal agent of Fusarium head blight. Wheat cv. Riband was used in the experiment. Four field trials (conducted in UK) are reported here, including both naturally and artificially inoculated trials in which the effect of fungicide treatments were noted on colonization by Fusarium and Microdochium, and on the production of deoxynivalenol [vomitoxin] (DON) mycotoxin. The pathogen populations were analysed with quantitative PCR and samples were tested for the presence of the mycotoxin DON. Application of fungicides to reduce Fusarium head blight gave a differential control of these fungi. Tebuconazole selectively controlled F. culmorum and F. avenaceum and reduced levels of DON, but showed little control of M. nivale. Application of azoxystrobin, however, selectively controlled M. nivale and allowed greater colonization by toxigenic Fusarium species. This treatment also lead to increased levels of DON detected. Azoxystrobin application two days post-inoculation increased the production of DON mycotoxin per unit of pathogen in an artificially inoculated field trial. This result indicates the potential risk of increased DON contamination of grain following treatment with azoxystrobin to control head blight in susceptible wheat cultivars. This is the first study to show differential fungicidal control of mixed natural pathogen populations and artificial inoculations in field trials.
PT: Journal-article
AN: 20013093436

TI: Loss of fuminosin B1 in extruded and baked corn-based foods with sugars.
AU: Castelo-MM; Jackson-LS; Hanna-MA; Reynolds-BH; Bullerman-LB

SO: Journal-of-Food-Science. 2001, 66: 3, 416-421; 29 ref.
LA: English
AB: The objective of this work was to determine the effect of added sugars on fumonisin B1 (FB1) levels in baked corn muffins and extruded corn grits. Muffins containing added glucose had significantly lower FB1 levels than muffins with sucrose, fructose, or no added sugar. Extrusion cooking of the grits resulted in significant reductions ($P < 0.05$) of FB1 in all treatments relative to unextruded controls, but use of glucose resulted in greater reductions of FB1 (45.3 to 71%) than did the use of fructose (29.5 to 53%) or sucrose (19.2 to 39%). When extrusion conditions were optimized, 92.1% loss of FB1 was found when grits were extruded with glucose. Adding glucose to thermally processed food can result in a substantial reduction in FB1 levels.
PT: Journal-article
AN: 20013102510

TI: Structure-activity relationships for human estrogenic activity in zearalenone mycotoxins.
AU: Shier-WT; Shier-AC; Xie-W; Mirocha-CJ
SO: Toxicon. 2001, 39: 9, 1435-1438; 29 ref.
LA: English
AB: Zearalenones are oestrogenic Fusarium mycotoxins consisting of a resorcinol moiety fused to a 14-member macrocyclic lactone. Using an improved MCF7 human breast cell proliferation assay, we have compared the oestrogenicity of 17 chromatographically-homogeneous zearalenones. Both similarities and substantial differences from published results in intact animal systems were observed. Substantial human oestrogenicity as retained even in analogues lacking hydroxylation on the aromatic and macrocyclic rings.
PT: Journal-article
AN: 20013107788

TI: Head blight (Fusarium graminearum) and deoxynivalenol concentration in winter wheat as affected by pre-crop, soil tillage and nitrogen fertilization.
AU: Yi-CuiLin; Kaul-HP; Kubler-E; Schwadorf-K; Aufhammer-W; Yi-CL
SO: Zeitschrift-fur-Pflanzenkrankheiten-und-Pflanzenschutz. 2001, 108: 3, 217-230; 56 ref.
LA: English
LS: German
AB: Fusarium head blight (FHB), caused by F. graminearum [Giberella zeae], is increasing worldwide. Fusarium mycotoxins are a serious threat to health, and a reliable control by fungicides is not possible, yet. The present study was conducted to evaluate the influence of different pre-crops and crop husbandry on FHB incidence in winter wheat test crops. In a 2-year (1997-99) factorial field experiment on the experimental station Ihinger Hof of the University of Hohenheim, Germany (480 m a. s. l., loam soil, 7,9 °C, 690 mm), inoculated pre-crops of maize or spring wheat were harvested for silage with only the stubble remaining in the field or for grain by combine with the whole straw remaining. Subsequently, crop residues were left on the soil surface or ploughed under before sowing winter wheat. Nitrogen fertilizer was applied to these test crops with calcium ammonium nitrate (CAN) or nitrolime. FHB was assessed by plot scores, by observations of disease incidence, disease severity and grain infection, indirectly via grain germination and by chemical deoxynivalenol [vomitoxin] (DON) analyses. The infection by FHB and the grain contamination with DON were similar after maize and spring wheat, either for silage or for grain, but the method of pre-crop inoculation by infected oat grains might have masked differences between pre-crops. The reductions of FHB incidence due to ploughing or nitrolime application were 27-32 % or 31-59 % compared with residues remaining on the surface or CAN fertilization, respectively.

Contemporary reductions in DON were less consistent. The assessment of percent infected ears can be recommended as a comparatively fast method for FHB evaluation that showed significant correlations with DON concentration and grain germination, too. But a reliable estimation of DON concentrations is not possible on the basis of infection assessments. In conclusion, crop health can be supported by crop husbandry to some degree, but FHB cannot be reliably controlled in susceptible rotations with abundant sources of inoculum.
PT: Journal-article
AN: 20013107793

TI: Effects of Fusarium culmorum head blight on mycotoxin accumulation and yield traits in barley doubled haploids.
AU: Chelkowski-J; Wisniewska-H; Adamski-T; Golinski-P; Kaczmarek-Z; Kostecki-M; Perkowski-J; Surma-M
SO: Journal-of-Phytopathology. 2000, 148: 9-10, 541-545; 24 ref.
LA: English
LS: German
AB: The susceptibility of barley doubled haploids (DH) to Fusarium head blight (FHB) was investigated. Heads of 24 DH lines (11 two-rowed and 13 six-rowed) derived from F1 Maresi (two-rowed) x Pomo (six-rowed) hybrids were inoculated with a conidial suspension of the single isolate IPO348-01 of Fusarium culmorum. The experiment was carried out in three consecutive years (1996-98) in one location. The number of kernels per ear, 1000-kernel weight and kernel weight per ear were recorded in inoculated and control plots. In the infected kernels nivalenol (NIV) content and deoxynivalenol (DON) content were determined. The effects of genotype, year and genotype-year interaction on reduction of yield traits were significant. For mycotoxin content only genotype and year effects were found to be important. The average NIV concentration in kernels of inoculated lines ranged from 0.15 mg/kg in the two-rowed line MP7 to 6.36 mg/kg in the six-rowed line MP113. A low accumulation of DON was observed in the studied population (from 0.01 to 0.20 mg/kg). Generally, no significant differences in mycotoxin content were found between two-rowed and six-rowed genotypes. The line MP7 was found to be superior -- with the lowest mycotoxin accumulation, and reduction in yield traits. Environmental conditions (years) affected DON and NIV level in kernels; however, the tendency to a lower or higher accumulation of mycotoxin in individual lines was stable over the years.
PT: Journal-article
AN: 20003015041

TI: Influence of some natural and synthetic toxins characteristic for Fusarium fungus on isoperoxidases in some wheat genotypes.
AU: Hagima-I; Ittu-M
SO: Romanian-Agricultural-Research. 1996, No. 5-6, 73-76; 8 ref.
LA: English
AB: Analyses of isoperoxidase activity at the seedling stage of three wheat genotypes (Fundulea 4 -- sensitive; 201 S -- medium resistant and Fundulea 29 -- resistant) with different degrees of field susceptibility to Fusarium were performed. The seedlings were grown under laboratory conditions, in media with different DON [vomitoxin] and NIV [nivalenol] concentrations. Other experimental variants included culture filtrates partially purified on a Florisil column. Electrophoresis in a 7% polyacrylamide gel revealed 10 banding patterns. The lowest number of isoperoxidases, 5, was recorded in Fundulea 4, cultivated on a medium with NIV, while the maximum number of isoenzymes, 9, was noted in Fundulea 29 and 201 S. Comparing these results with those obtained under field artificial inoculation applied

directly in the ear at anthesis, a good correspondence was obtained with assessment of some yield parameters (reduction of ear weight as well as of seed weight per ear as compared to both the uninoculated check and infected plants). Thus, isoenzyme polymorphism proved useful in evaluating genetic diversity of germplasm for resistance to Fusarium at the seedling stage.
PT: Journal-article
AN: 20013007225

TI: Characterization of Gibberella fujikuroi complex isolates by fumonisin B1 and B2 analysis and by RAPD and restriction analysis of PCR-amplified internal transcribed spacers of ribosomal DNA.
AU: Jimenez-M; Rodriguez-S; Mateo-JJ; Gil-JV; Mateo-R
SO: Systematic-and-Applied-Microbiology. 2000, 23: 4, 546-555; Many ref.
LA: English
AB: Twenty nine isolates of Fusarium spp. (24 of them belonging to the Gibberella fujikuroi complex) isolated from banana and corn [maize] from different geographical regions were analyzed for their ability to produce fumonisins B1 and B2 and for genetic relatedness using random amplified polymorphic DNA (RAPD) and restriction analysis of PCR amplification products of the 5.8s ribosomal DNA-intervening internal transcribed spacer regions (ITS I-5.8S-ITS II). For RAPD analysis, 6 of 20 oligonucleotide primers were selected after testing with 5 Fusarium spp. isolates and used to characterize 24 additional isolates. DNA fragments from the 29 isolates of Fusarium spp., which were approx. 560 bp, were amplified with the universal primers ITS1 and ITS4. The restriction enzymes HaeIII, MboI, HpaII and MspI were useful for distinguishing the isolates. The RAPD analysis permitted to find interspecific differences among the isolates of Fusarium spp., between isolates with low and high capacity of fumonisin production and among isolates from different hosts. The restriction fragment length polymorphism (RFLP-PCR) analysis permitted to distinguish among different species of Fusarium. In combination with morphological analysis, the results of this research may find an application for the diagnosis of unknown Fusarium spp. and, particularly, for the characterization of fumonisin-producing isolates, which may be very useful in the food technology field.
PT: Journal-article
AN: 20013022962

TI: Pathogenicity and zearalenone production by different Fusarium graminearum isolates in artificially infected wheat grain.
AU: Bagi-F; Balaz-F; Skrinjar-M
SO: Cereal-Research-Communications. 2000, 28: 4, 477-484; 47 ref.
LA: English
AB: Nine F. graminearum [Gibberella zeae] isolates were investigated for their pathogenicity on wheat ears and zearalenone production. The investigated isolates originated from different geographical regions and included representatives of Group 1 and Group 2 of F. gramineraum species. Among these isolates significant differences in pathogenicity were found. Groups 1 and 2 included isolates with higher and lower pathogenicity. 44.4% of the isolates produced zearalenone in artificially infected wheat grains at concentrations ranging from 203 to 431 µg per kg. Isolates of both groups are capable of zearalenone synthesis.
PT: Journal-article
AN: 20013030709

TI: Fusariotoxins in kernels of winter wheat cultivars field samples collected during 1993 in Poland.
AU: Grabarkiewicz-Szczesna-J; Kostecki-M; Golinski-P; Kiecana-I
SO: Nahrung. 2001, 45: 1, 28-30; 27 ref.
LA: English
AB: In the South-Eastern region of Poland (near Lublin), frequency of scab (fusariosis) is much higher than in other parts of the country. During the 1993 harvest grains of 25 winter wheat cultivars were collected. On the basis of morphological studies, Fusarium graminearum [Gibberella zeae] was found in 42% of investigated samples while other fungi appeared less frequently: F. nivale [Monographella nivalis] and F. poae (35%), F. avenaceum [Gibberella avenacea] (31%) and F. culmorum (12%). Chemical analysis (by HPLC) revealed that the tested cultivars were contaminated with deoxynivalenol (96% of investigated samples), its acetyl derivatives (48%), nivalenol (76%) and moniliformin (28%). The average levels of the metabolite concentrations were as follows: 104; 16; 97; and 63 µg/kg, respectively. Co-occurrence of 2 toxic metabolites was found in the following percentage of the positive samples: deoxynivalenol and nivalenol (72%), deoxynivalenol and moniliformin, as well as nivalenol and moniliformin (24%). Usually (71-83% of contaminated samples) mycotoxins were accumulated in the concentration range _10, < 100 µg/kg.
PT: Journal-article
AN: 20013031529

TI: Identification of deoxynivalenol, 3-acetyldeoxynivalenol and zearalenone in the galactose oxidase-producing fungus Dactylium dendroides.
AU: Machado-LCH; Kemmelmeier-C
SO: Mycopathologia. 2001, 149: 2, 79-85; 37 ref.
LA: English
AB: The galactose oxidase-producing fungus Dactylium dendroides was re-identified as a Fusarium species. Fungi of this genus are well known for the production of mycotoxins. Verification of growth of this fungus on rice, corn [maize] and liquid medium described for the production of galactose oxidase is provided to determine whether the fungus could produce Fusarium toxins, namely, moniliformin, fusaric acid, fumonisin, zearalenone and the trichothecenes, deoxynivalenol [vomitoxin], 3-acetyldeoxynivalenol, fusarenone, nivalenol, diacetoxyscirpenol, neosolaniol and T-2 toxin. Under the culture conditions used, vomitoxin, 3-acetyldeoxynivalenol and zearalenone were detected in the fungal culture medium. The finding is consistent with the hypothesis that the fungus is in fact a Fusarium species.
PT: Journal-article
AN: 20013036968

TI: Mycotoxins in pig feeds. 1: Source of toxins, prevention and management of mycotoxicosis.
AU: Lawlor-PG; Lynch-PB
SO: Irish-Veterinary-Journal. 2001, 54: 3, 117-120; 16 ref.
LA: English
AB: Mycotoxins affect up to 25% of the world food crops. They cause significant economic losses in animal agriculture; some are carcinogens and teratogens, and may be transmitted to man in meat and milk. They are produced mainly by three genera of moulds: Aspergillus, Penicillium and Fusarium. Their presence can be confirmed using commercially available ELISA kits but quantification requires laboratory analysis using thin layer chromatography (TLC) or liquid chromatography (LC). Mixing contaminated and uncontaminated feedstuffs, the use of binding agents (e.g., clays and mannanoligosaccharide) and the feeding of higher

than normal levels of high molecular weight amino acids have all been used with varying degrees of success to lessen the effect of mycotoxins on pig performance. Preventing mould growth and subsequent mycotoxin production during storage of feeds is more successful. This is achieved by storing clean grain at a moisture content less than 14% in clean, preferably insulated bins. If grain must be stored at a higher moisture content or if storage conditions are poor then a suitable mould inhibitor (e.g., propionic acid) should be used. Native grown cereals may be contaminated with vomitoxin, zearalenone, fusaric acid or ochratoxin. The presence of aflatoxins in animal feeds in Ireland is most likely to be due to the importation of feed ingredients from warmer climates. Routine testing should be carried out at mills so that contaminated ingredients can be rejected or identified for feeding to the least susceptible species and type of animal.
PT: Journal-article
AN: 20013037355

TI: Agonistic and antagonistic effects of zearalenone, an etrogenic mycotoxin, on SKN, HHUA, and HepG2 human cancer cell lines.
AU: Withanage-GSK; Murata-H; Koyama-T
SO: Veterinary-and-Human-Toxicology. 2001, 43: 1, 6-10; 24 ref.
LA: English
AB: Zearalenone (ZEA) is a nonsteroidal estrogenic compound mainly produced by the moulds Fusarium graminearium and Fusarium culmorum found in a variety of host plants and soil debris around the world. ZEA is usually non-lethal to animals but is important to livestock producers because its hyperestrogenic effects adversely influence the reproductive performance of animals. There have been suggestions of possible involvement of ZEA in the progression of breast malignancies and tumors of the female reproductive tract in humans. The toxic or stimulatory effects of ZEA and its metabolites alpha-zearalenol and 17-beta-estradiol on SKN, HHUA and HepG2 cells were studied using rapid colorimetric MTT assay. In general, both concentrations of 17-beta-estradiol (100M and 10 nM) were toxic to SKN and HHUA cell cultures. Both ZEA and alpha-zearalenol stimulated the proliferation of SKN and HHUA cells. On HepG2 cells, lower concentrations (10 nM) of 17-beta-estradiol and higher concentrations (100 µM) of ZEA exhibited toxic effects, whereas treatment with higher concentrations of 17-beta-estradiol and lower concentration of ZEA did not show toxic effects. A dose dependent antagonistic effect was observed when the cell cultures were pre-incubated with ICI 182,780, a synthetic oestrogen receptor blocker, before estradiol or mycotoxin treatments.
PT: Journal-article
AN: 20013039347

TI: An approach to toxicity of Fusarium mycotoxin, DON: use in co-culture system with human intestinal cells.
AU: Sugita-Konishi-Y
SO: Mycotoxins. 2001, 51: 1, 37-40; 17 ref.
LA: English
LS: Japanese
AB: A technique is described to measure the toxicity of mycotoxins using co-culture systems with human intestinal cells and target calls. The system is a simple method of interfacing, using chambers systems with commercially available filter supports on which epithelial monolayers can be grown. Cultured target cells of mycotoxin, such as lymphocyte, nerve cells, hepatocytes etc., can be cultured under the grown epithelial monolayer cells, and the responses of target cells are examined when the epithelial cell was exposed to contaminants

on the apical side of intestinal epithelial cells. As an application of this system, we examined the toxicity of deoxynivalenol [vomitoxin] (DON) on lymphocytes through intestinal epithelial cells, Caco-2 cells. The exposure of intestinal epithelial cells to DON resulted in the production of cytokines (IL-10 and IL-12).
PT: Journal-article
AN: 20013040154

TI: Variation among isolates of Fusarium graminearum associated with Fusarium head blight in North Carolina.
AU: Walker-SL; Leath-S; Hagler-WM Jr.; Murphy-JP
SO: Plant-Disease. 2001, 85: 4, 404-410; 19 ref.
LA: English
AB: Fusarium head blight (FHB) can reduce yield of wheat and decrease the value of harvested grain by accumulation of detrimental toxins. Understanding the variability of the fungal population associated with infection could improve disease control strategies. Sixty-six isolates of F. graminearum [Gibberella zeae] associated with FHB were collected in North Carolina and tested for in vitro growth rate, in vitro production of deoxynivalenol [vomitoxin] (DON) and zearalenone, and pathogenicity on three cultivars of soft red winter wheat. Significant differences among isolates were found for all three traits. Randomly amplified polymorphic DNA analysis revealed high levels of genotypic diversity among isolates. Isolates of F. graminearum, F. culmorum, and F. avenaceum acquired from the Pennsylvania State University Fusarium Center were included for comparison in all tests. In vivo levels of DON were measured for the five isolates associated with the highest levels of disease and the five isolates associated with the lowest levels of disease, and no significant differences were found. However, all ten isolates produced detectable levels of DON in vivo. Mean disease ratings ranged from 3.4 to 96.4%, in vitro DON levels ranged from 0 to 7176.2 ppm, and zearalenone ranged from 0 to 354.7 ppm, among isolates. A multiple regression model using in vitro growth, in vitro DON, and zearalenone production, collection location, wheat cultivar of isolate origin, plot, tillage conditions, and previous crop as independent variables and percent infected tissue as the dependent variable was developed. The cumulative R2 value for the model equaled 0.27 with in vitro rate of growth making the largest contribution. Analysis of phenotype and genotype among isolates demonstrated diversity in a single plot, in a single location, and in North Carolina. Genotypic and phenotypic diversity were significant under both conventional and reduced tillage conditions, and diversity was high regardless of whether the previous crop had been a host or non-host for F. graminearum. These data indicate a variable pathogen population of F. graminearum exists in North Carolina, and members of this population can be both highly pathogenic on wheat and produce high levels of detrimental toxins, indicating a potential threat for problems with FHB within the state.
PT: Journal-article
AN: 20013049537

TI: Mycotoxins in pig feeds 2: clinical aspects.
AU: Lawlor-PG; Lynch-PB
SO: Irish-Veterinary-Journal. 2001, 54: 4, 172-176; 37 ref.
LA: English
AB: Mycotoxins affect up to 25% of the world's food crops. As well as causing significant economic losses to animal agriculture, some mycotoxins are carcinogens and/or teratogens that may be transmitted to the human population in meat or milk. In general, they are produced by three genera of moulds: Aspergillus, Penicillium and Fusarium. The clinical response to mycotoxins is dependent on the concentration in feed, on the duration of feeding,

on the presence or absence of other mycotoxins, and on the species, age, and health status of animal to which the mycotoxin is fed. The clinical response can vary from acute to chronic. Vomitoxin causes pigs to refuse feed, zearalenone affects the reproductive organs, ochratoxin causes kidney damage and aflatoxins increase susceptibility to disease through their action as immunosuppressants. Aflatoxins can also cause haemorrhages and digestive disorders.
PT: Journal-article
AN: 20013049678

TI: The threat to animal performance from feed and forage mycotoxins.
AU: Smith-TK; MacDonald-EJ; Haladid-S
SO: Feed-Compounder. 2001, 21: 4, 24-27; 22 ref.
LA: English
AB: The feeding of blends of grains and soyabean meal increases the chances of aflatoxin and Fusarium mycotoxins in the diet. The major effect of these toxins on livestock and poultry is loss of appetite. Pigs are the most sensitive to the dietary deoxynivalenol followed by poultry. To overcome mycotoxin in commercial feed preparations, a binding agent like Mycosorb can be used to prevent metabolic changes by stopping intestinal absorption of mycotoxin with widely varying molecular weights and charges.
PT: Journal-article
AN: 20013056154

TI: Investigation and a new evaluation method of the resistance of maize hybrids grown in Hungary to Fusarium moulds.
AU: Bata-A; Rafai-P; Kovacs-G
SO: Journal-of-Phytopathology. 2001, 149: 2, 107-111; 23 ref.
LA: English
LS: German
AB: Thirty maize hybrids grown in Hungary representing groups FAO 200-299, FAO 400-499 and FAO 500-were studied in 1993 and 1994 in order to obtain information about genotypic resistance to Fusarium moulds. The plants were grown on an experimental farm and were inoculated using the toothpick method with Fusarium graminearum [Gibberella zeae] and Fusarium culmorum. In addition maize grain meals were also inoculated with isolates of moulds. Measurements were made of the mould-covered surface area of the ears 9 weeks after inoculation and of the zearalenone and T2-toxin content of the inoculated maize meals. Large differences among hybrids were observed for the mould- covered area of the ear surface (2.00-38.88%), the zearalenone content (4.20-71.20 mg/kg) and the T2-toxin content (1.60-122.50 mg/kg). Relatively poor correlation (r = 0.489) was found between the area of mould covering the ear surface and mycotoxin content of maize. Bearing in mind that the user of feed grain is interested in obtaining a feed with the lowest mycotoxin content, a new method of evaluation of hybrids which uses a toxin-mould index (TMI) was introduced. This index is calculated on the basis of both growth rate of moulds and their toxin-producing activity. Although a decreasing tendency in resistance of hybrids with a longer growing vegetation period could be observed, resistant genotypes were found in every FAO group, confirming the views that in addition to the influence of duration of the vegetation period on the resistance, genetic factors may also play a significant role.
PT: Journal-article
AN: 20013056739

TI: Resistance to fusarium head blight in winter wheat: heritability and trait associations.
AU: Buerstmayr-H; Steiner-B; Lemmens-M; Ruckenbauer-P

SO: Crop-Science. 2000, 40: 4, 1012-1018; 41 ref.
LA: English
AB: Fusarium head blight (FHB) or scab caused by Fusarium spp. is a widespread disease of cereals, causing significant yield losses and contaminating cereal products with mycotoxins. The complex inheritance of resistance has hampered progress in breeding resistant, agronomically adapted cultivars. To streamline breeding for FHB resistance, we estimated genetic and environmental variance components and broad-sense heritability in two winter wheat (Triticum aestivum) populations, determined the association of FHB (caused by F. culmorum strain IPO 39-01) resistance with other traits (flowering date, plant height, and awnedness), and determined the level of maternal effects on FHB resistance. The moderately susceptible Austrian cultivar Capo was crossed with two resistant lines, one from Hungary (UNG-226) and one from the Netherlands (SVP-72017). A hierarchical design was applied to develop recombinant F4-derived lines. Head blight resistance was measured by visual assessment of disease symptoms in artificially inoculated, mist-irrigated field experiments during 1995-96 in IFA-Tulln, 30 km west of Vienna, Austria. Artificial inoculation and mist irrigation led to reproducible FHB infections. High broad-sense heritabilities (H > 0.75) were measured for FHB resistance, allowing for considerable progress by selection. The magnitude of additive genetic variance was greater than additive x additive epistatic variance. Despite a significant negative correlation between visual FHB symptoms and plant height (r = -0.37), the successful selection of short and FHB resistant genotypes should be feasible. In only one population, awned progeny showed slightly reduced FHB. Reciprocal effects were significant in one cross only. The development of FHB resistant cultivars should be possible by phenotypic selection under epidemic conditions, and should be largely independent of plant height, flowering date, awnedness, and genotype of the maternal parent within a cross.
PT: Journal-article
AN: 20013062192

TI: Molecular biology of mycotoxin biosynthesis.
AU: Sweeney-MJ; Dobson-ADW
SO: FEMS-Microbiology-Letters. 1999, 175: 2, 149-163; 50 ref.
LA: English
AB: Mycotoxins are secondary metabolites produced by many important phytopathogenic and food spoilage fungi including Aspergillus, Fusarium and Penicillium species. The toxicity of four of the most agriculturally important mycotoxins (the trichothecenes, and the polyketide-derived mycotoxins; aflatoxins, fumonisins and sterigmatocystin) are discussed and their chemical structure described. The steps involved in the biosynthesis of aflatoxin and sterigmatocystin and the experimental techniques used in the cloning and molecular characterization of the genes involved in the pathway are described in detail. The biosynthetic genes involved in the fumonisin and trichothecene biosynthetic pathways are also outlined. The potential benefits gained from an increased knowledge of the molecular organization of these pathways together with the mechanisms involved in their regulation are also discussed.
PT: Journal-article
AN: 20013063399

TI: The toxicity of fumonisin B1, B2, and B3, individually and in combination, in chicken embryos.
AU: Henry-MH; Wyatt-RD
SO: Poultry-Science. 2001, 80: 4, 401-407; 25 ref.
LA: English

AB: Three recently described and toxicologically important mycotoxins, fumonisin B1 (FB1), B2 (FB2) and B3 (FB3), produced by Fusarium moniliforme in various grains, have been associated with a number of diseases in both humans and animals. The toxicity of purified FB1, FB2, and FB3, individually and in combination (3:1:1 ratio), were evaluated in terms of embryo toxicity by injection of the toxins into the air cell of 186 chicken eggs at 72 h of incubation. Under these conditions, FB1 at doses of 0, 2, 4, 8, 16, 32, and 64 µg per egg resulted in embryonic mortality of 5, 12.5, 17.5, 20.0, 52.5, 77.5, and 100%, respectively. The 50% lethal dose for FB1, when injected into the air cell of embryonating chicken eggs, was 18.73 µg per egg. Comparison of the toxicity of FB1, FB2 and FB3, individually and in combination (3:1:1 ratio) at doses of 16 µg of total fumonisin per egg, indicated that the toxicity of the fumonisins differed, FB1 being the most toxic. Microscopic examination of chicken embryos exposed to fumonisin did not reveal any gross developmental abnormalities; however, severe haemorrhages of the head, neck and thoracic area of the dead embryos were evident.
PT: Journal-article
AN: 20013064053

TI: Effect of climatic conditions on natural mycoflora and fumonisins in freshly harvested corn of the State of Parana, Brazil.
AU: Ono-EYS; Sugiura-Y; Homechin-M; Kamogae-M; Vizzoni-E; Ueno-Y; Hirooka-EY
SO: Mycopathologia. 1999, 147: 3, 139-148; 41 ref.
LA: English
AB: The natural mycoflora associated with fumonisins were analyzed in 150 samples of freshly harvested corn [maize] from central-southern, central-western and northern regions of the State of Parana, Brazil, during April 1995 and March-April 1996, and correlated with climatic conditions. The maize samples were frequently contaminated with Fusarium sp. (98.7-100%) and Penicillium sp. (93-100%). The highest contamination with potentially toxinogenic fungi occurred in maize harvested in the central-western region, where total mould and yeast counts ranged from 5.5 x 103 to 5.2 x 106 colony forming units (CFU)/g, with 98.7% contaminated by Fusarium sp. and 93% by Penicillium sp. In this region, F. moniliforme [Gibberella fujikuroi] was the predominant Fusarium sp., and was isolated in 85.9% of samples. Aspergillus sp. was isolated from 27.7% of samples. Fumonisin B1 (FB1) was detected in 100% of samples (mean concentration of 2.39 µg/g) and FB2 in 97.7% (mean of 1.09µg/g). Fumonisins were also detected in all samples from the northern region, with mean of 4.56 µg/g (FB1) and 2.20 µg/g (FB2). Considering 1.0 µg/g as the threshold, 72% of the maize samples from the central-west and 92% from the north were contaminated with concentrations above this value, in contrast to an 18.5% contamination rate from central-southern samples. Between the maize planting to harvesting season, the average maximum temperature and relative humidity were 26°C and 77.1% (central-southern), 27°C and 69% (northern) and 29.9°C and 89.1% (central-western). It is concluded that the higher fumonisin contamination of maize from the northern region when compared to the central-south region was due to the differences in rainfall levels (92.8 mm in central-southern, 202 mm in northern) during the month preceding harvest.
PT: Journal-article
AN: 20003004366

TI: The occurrence of HT-2 toxin and other trichothecenes in Norwegian cereals.
AU: Langseth-W; Rundberget-T
SO: Mycopathologia. 1999, 147: 3, 157-165; 49 ref.
LA: English

AB: A total of 449 grain samples, comprising 102 barley, 169 wheat and 178 oat samples, were collected from different regions of Norway from crops harvested during 1996-98, mainly from grain loads and silos. The samples were analyzed for type A and B trichothecenes, the largest groups of mycotoxins produced by the Fusarium species, by gas chromatography with mass spectrometric detection (GC-MS). Factors affecting the presence of the different trichothecenes are discussed. Deoxynivalenol [vomitoxin] (DON) and HT-2 toxin were the trichothecenes most frequently detected, followed by T-2 toxin, nivalenol and scirpentriol; scirpentriol being detected only in 7 samples (> 20 µg/kg). Oats were the grain species most heavily contaminated, with an incidence (% > 20 µg/kg) and mean concentration of positive samples of 70% (115 µg/kg) for HT-2 toxin, 30% (60 µg/kg) for T-2 toxin, 57% (104 µg/kg) for DON, and 10% (56 µg/kg) for nivalenol. The corresponding values for barley were 22% (73 µg/kg), 5% (85 µg/kg), 17% (155 µg/kg) and 6% (30 µg/kg), and for wheat 1.2% (20 µg/kg), 0.6% (20 µg/kg), 14% (53 µg/kg) and 0% for HT-2, T-2, DON and nivalenol, respectively. Norwegian oats were found to contain HT-2 and T-2 toxin in concentrations that might be a threat to human health for a high consumers of oats. The amount of DON was significantly lower than in the crop from previous years.
PT: Journal-article
AN: 20003004368

TI: Mapping of quantitative trait loci for fusarium head blight resistance in barley.
AU: Ma-ZhengQiang; Steffenson-BJ; Prom-LK; Lapitan-NLV; Ma-ZQ
SO: Phytopathology. 2000, 90: 10, 1079-1088; 35 ref.
LA: English
AB: Fusarium head blight (FHB) is a devastating disease that causes significant reductions in yield and quality in wheat and barley. Barley grains infected with deoxynivalenol (DON), a vomitoxin produced by Fusarium graminearum [Gibberella zeae], are rejected for malting and brewing. Among six-rowed barley cultivars tested thus far, only cv. Chevron exhibited resistance. This study was conducted to map genes and to identify DNA markers for marker-assisted breeding for FHB resistance in cv. Chevron with restriction fragment length polymorphism (RFLP) markers. A doubled haploid (DH) population was created from a cross between cv. Chevron and susceptible cv. Stander. Seven field experiments were conducted in four different locations in 2 years. A RFLP map containing 211 loci and covering over 1,000 centimorgans (cM) of the genome was used to map quantitative trait loci (QTL) associated with relatively low FHB severity and DON concentration. Morphological traits differing between the parents were also measured: heading date, plant height, spike angle, number of nodes per cm of rachis in the spike, and kernel plumpness. Many of the QTL for FHB and DON coincided with QTLs for these morphological traits. The "fix-QTL" algorithm in Mapmaker QTL was used to remove the part of the variance for FHB resistance that may be explained by heading date or plant height. Results from this study suggest that QTLs with major effects for FHB resistance probably do not exist in cv. Chevron. Three QTL intervals, Xcmwg706-Xbcd441 on chromosome 1H, Xbcd307b-Xcdo684b on chromosome 2H, and Xcdo959b-Xabg472 on chromosome 4H, that are not associated with late heading or height may be useful for marker-assisted selection.
PT: Journal-article
AN: 20003005806

TI: Sequential distribution of the mycotoxin deoxynivalenol in wheat spikes after inoculation with Fusarium graminearum.
AU: Savard-ME; Sinha-RC; Seaman-WL; Fedak-G
SO: Canadian-Journal-of-Plant-Pathology. 2000, 22: 3, 280-285; 17 ref.

LA: English
LS: French
AB: One central spikelet of spring wheat (Triticum aestivum) cv. Roblin spikes was inoculated with macroconidia of Fusarium graminearum and the entire spikes were harvested at 2- to 4-day intervals from 2 to 25 days after inoculation. The spikes were dissected and the amount of deoxynivalenol (DON) in each spikelet and in each internode of the rachis was measured by enzyme-linked immunosorbent assay (ELISA) with monoclonal antibodies. High concentrations of DON were first detected in the inoculated spikelets, 4 days after inoculation. DON concentrations in the spikelets below the inoculation point eventually reached 500-600 ppm while the corresponding internodes of the rachis contained 1000-1200 ppm. Much lower amounts of DON were found in spikelets and rachis above the inoculation point.
PT: Journal-article
AN: 20003012931

TI: The toxicity of purified fumonisin B1 in broiler chicks.
AU: Henry-MH; Wyatt-RD; Fletcher-OJ
SO: Poultry-Science. 2000, 79: 10, 1378-1384; 44 ref.
LA: English
AB: An investigation of the toxicity of fumonisin B1 (FB1), a toxic metabolite of Fusarium moniliforme, in 120 broiler chicks was conducted. Purified FB1 (98.1% pure) was incorporated into the diets of broiler chicks at 0, 20, 40 and 80 mg/kg, and fed to chicks from 0 to 21 d of age. Dietary FB1, at concentrations of 80 mg/kg or less, did not adversely affect body weight, feed efficiency or water consumption of broiler chicks. The relative weights of the liver, spleen, kidney, proventriculus and bursa of Fabricius were also unaffected ($P < 0.05$) by any dietary concentration of FB1 compared with the control (0 mg/kg) group. Total liver lipids of chicks fed 40 or 80 mg FB1/kg were significantly lower than those of the chicks fed either 0 or 20 mg FB1/kg of feed. Liver sphinganine concentration and the sphinganine:sphingosine ratio were increased significantly in all treated groups. Chicks fed dietary FB1 at 80 mg/kg had significantly higher serum glutamate oxaloacetate aminotransaminase:aspartate aminotransferase ratios and levels of free sphinganine in the serum. The results of this investigation agree with the results previously described, in which FB1 was supplied to diets from the use of F. moniliforme-contaminated grain; therefore, the use of such material as the source of the mycotoxin in animal feeding studies is appropriate.
PT: Journal-article
AN: 20003018713

TI: Influence of fusarium toxins on growth and carcass characteristics of turkeys.
AU: Leitgeb-R; Lew-H; Khidr-R; Bohm-J; Zollitsch-W; Wagner-E
SO: Bodenkultur. 2000, 51: 3, 171-178; 22 ref.
LA: English
LS: German
AB: In a feeding trial with 60 turkeys in 4 feeding groups the effects of mycotoxin contaminated maize on growing performance and carcass traits, chemical composition of eviscerated carcass, organoleptic traits and biochemical parameters of blood were investigated. Four diets with different levels of mycotoxin contamination were tried. In feeding group 1 uncontaminated maize was used, and in feeding groups 2, 3 and 4, 1/3, 2/3 and all uncontaminated maize were substituted by mycotoxin contaminated maize. The percentage of maize in starter feed, and grower diets I and II was 36.8, 48.9 and 59.3%, respectively. The contaminated maize contained 4.94 mg moniliformin, 3.24 mg beauvericin,

2.02 mg deoxynivalenol, and 0.35 mg fumonisin B1 per kg. At the end of the growing period (77 days) liveweight of turkeys of groups 1, 2, 3 and 4 was 6.71, 6.26, 6.33 and 6.27 kg and feed conversion rate was 2.07, 2.16, 2.23 and 2.19, respectively. The dressing percentages of eviscerated carcass and roast carcass, the weight of heart, liver, Bursa fabricii, spleen and the valuable parts of carcass showed no significant differences between the feeding groups. The DM content of eviscerated carcass decreased (P=0.10) from 31.5 to 31.1, 30.9 and 30.1% for feeding groups 1, 2, 3 and 4, respectively. The organoleptic traits (tenderness, juiciness and taste) of breast meat and the biochemical parameters of blood were not at all influenced by the contaminated feed. The experiment shows that maize contaminated with fusarium toxins had negative effects on growing performance only in the first 8 weeks of age, but not later on.
PT: Journal-article
AN: 20003021826

TI: An investigation of the concentrations of selected Fusarium mycotoxins and the degree of mold contamination of field-dried hay.
AU: Raymond-SL; Heiskanen-M; Smith-TK; Reiman-M; Laitinen-S; Clarke-AF
SO: Journal-of-Equine-Veterinary-Science. 2000, 20: 10, 616-621; 31 ref.
LA: English
AB: The levels of selected mycotoxins and mould contamination of field-dried hay from 10 performance horse farms in Ontario, Canada, sampled in May 1996, were examined. The farm owner, trainer or manager was questioned regarding their opinion of the quality of the hay. Half of the hay sampled showed potentially significant levels of mycotoxins, mould and actinomycete contamination. Fungi isolated included Fusarium, Eurotium, Alternaria, Aspergillus and Cladosporium. Subjective opinion did not correlate to objective analysis. Deoxynivalenol [vomitoxin], T 2 toxin and zearalenone were measured with vomitoxin present in the highest amounts. Vomitoxin is among the mycotoxins most frequently found as contaminants in cereal crops, in temperate climates, in North America. It is concluded that the levels found in this study could potentially have an influence on the health of horses consuming such hay.
PT: Journal-article
AN: 20003023587

TI: Genetic determination of variability of barley doubled haploids inoculated with Fusarium culmorum (W.G.Sm.) Sacc. with regard to mycotoxin accumulation and reduction in yield traits.
AU: Surma-M; Adamski-T; Chelkowski-J; Golinski-P; Kaczmarek-Z; Kostecki-M; Perkowski-J; Wisniewska-H
SO: Journal-of-Applied-Genetics. 2000, 41: 4, 237-246; 24 ref.
LA: English
AB: The genetic determination of variability of barley doubled haploid (DH) lines in regard of their susceptibility to Fusarium head blight caused by Fusarium culmorum was studied. The susceptibility was evaluated in a 3-year field experiment on the basis of reduction in yield traits and mycotoxin accumulation in infected kernels. The following traits were analysed in inoculated and control plants: kernel number and weight per ear, 1000-kernel weight, percentage of plump kernels (> 2.5 mm), deoxynivalenol [vomitoxin] (DON) content and nivalenol (NIV) content of kernels. On the basis of the obtained data, heritability coefficient (ratio of genotypic to phenotypic variance) was assessed, and genetic parameters as well as the number of effective factors were estimated. Heritability coefficients calculated from two-way analysis of variance, i.e. regarding the influence of years and year x genotype interaction, appeared to be exceptionally low and ranged from 5.2% for the reduction in plump kernels to

38.2% for the reduction in 1000-kernel weight. In the case of mycotoxin accumulation about 60% of the observed variability in NIV concentration and 30% in DON concentration resulted from genetic differences among lines. Additive effects of genes were important for all the analysed traits. Significant effects of dominance and dominance x dominance were observed for 1000-kernel weight and percentage of plump kernels. Moreover, it was found that the observed variability in yield trait reduction resulted from the segregation of 5-6 effective factors, DON content from 4 factors, while NIV content from 5 factors.
PT: Journal-article
AN: 20003034332

TI: Immunohistochemistry of fumonisin in poultry using avidin-biotin-peroxidase system.
AU: Buim-MR; Bracarense-APFRL; Guimaraes-IG; Kawamura-O; Ueno-Y; Hirooka-EY
SO: Natural-Toxins. 1999, 7: 6, 279-282; 19 ref.
LA: English
AB: Using monoclonal anti-fumonisin B1 antibody (anti-FB1) and avidin-biotin-peroxidase system, liver and kidneys of broiler chicks were evaluated for the detection and distribution of fumonisins (FBs). 150 micrograms of FB1 or culture extract of Fusarium moniliforme [Gibberella fujikuroi] str. 113F containing 150 µg of FB1 and 4 µg of FB2 were administered into the vitelline sac of 1-day old, specific pathogen-free chicks. The animals were killed 24 h after injection, and renal and hepatic tissues submitted for immunohistochemical analysis. FBs were detected in the epithelial cells of convoluted distal and proximal tubules of the kidneys, as well as in the cytoplasm of hepatocytes. This novel immunohistochemical method developed is expected to be an efficient way for monitoring the target of the FB toxins in tissues.
PT: Journal-article
AN: 20003036989

TI: Aflatoxin B1 and fumonisin B1 in mixed cultures of Aspergillus flavus and Fusarium proliferatum on maize.
AU: Picco-M; Nesci-A; Barros-G; Cavaglieri-L; Etcheverry-M
SO: Natural-Toxins. 1999, 7: 6, 331-336; 25 ref.
LA: English
AB: Production of aflatoxin B1 and fumonisin B1 in pure and mixed cultures of A. flavus and F. proliferatum were determined on irradiated maize seeds inoculated with different spore concentrations at 0.97 water activity (aw) and a temperature of 25°C. The highest levels of aflatoxin B1 were produced by A. flavus at the lowest levels of inoculum (103 spores/ml). There was no spore concentration influence on fumonisin B1 production after 10, 20 and 35 days of incubation. When A. flavus was co-inoculated with F. proliferatum, aflatoxin B1 production was inhibited. The higher the inocula levels of Fusarium produced, the higher the inhibition and this inhibition increased during the incubation period. Total inhibition was reached at 35 days of incubation. There was no interaction influence on fumonisin B1 production at all inoculum levels assayed. These results suggest that under optimal environmental conditions of substrate, water activity and temperature, the interaction between A. flavus and F. proliferatum could produce inhibition of aflatoxin B1 and stimulation of fumonisin B1.
PT: Journal-article
AN: 20003036995

TI: HPLC/MS analysis of Fusarium mycotoxins, fumonisins and deoxynivalenol.
AU: Plattner-RD

SO: Advances in Detection Methods for Fungal and Algal Toxins. Proceedings from a workshop, Salisbury Cove, Maine, USA, 17-19 June 1999. Natural-Toxins. 1999, 7: 6, 365-370; 13 ref.
LA: English
AB: High performance liquid chromatography/mass spectrometry (HPLC/MS) was found to be a convenient analytical method to detect and quantify the naturally occurring fumonisin homologues and deoxynivalenol [vomitoxin] in extracts from grains and food products. The fumonisins are detected primarily as protonated molecules in the positive ion electrospray ionization (ESI) mode as they elute from a C-18 reverse phase column during a methanol water gradient containing acetic acid to facilitate chromatography. Vomitoxin can be detected as positive or negative ions in the atmospheric pressure chemical ionization (APCI) mode or in the negative ion ESI mode. One nanogram amounts of fumonisins or vomitoxin injected into the HPLC system are easily detected with signal to noise allowing detection limits of 1 µg/g or better to easily be achieved with minimal clean-up of grain extracts.
PT: Journal-article; Conference-paper
AN: 20003037000

TI: Prevalence of Fusarium species of the Liseola section on Zimbabwean corn and their ability to produce the mycotoxins zearalenone, moniliformin and fumonisin B1.
AU: Mubatanhema-W; Moss-MO; Frank-MJ; Wilson-DM
SO: Mycopathologia. 1999, 148: 3, 157-163; 32 ref.
LA: English
AB: Maize samples were collected from 9 Grain Marketing Board (G.M.B.) centres in Zimbabwe during the 1991 harvest season. A further 47 samples were collected directly from farmers and from the G.M.B., centres in Chinhoyi and Kwekwe during the 1992 harvest season. These samples were analysed mycologically and the predominant flora was Fusarium although Penicillium, Nigrospora, Aspergillus and Chaetomium could be isolated from some samples. From the first 9 samples studied, F. verticillioides and F. subglutinans were isolated in almost equal proportions on samples from the central and the south of the country whereas only F. verticillioides was isolated on the samples from the north. The subsequent study demonstrated that there was a greater fungal diversity in samples from North (Mashonaland West) than samples from the South (Midlands area) with species of Nigrospora, Chaetomium, Acremonium and Diplodia occurring in significant numbers. From a total of 2821 fungal isolates obtained from all the maize samples analysed, 1485 (53%) were found to belong to the Liseola section of Fusarium. The ability of these isolates to produce zearalenone, moniliformin and fumonisin B1 was tested using a simplified TLC Agar plate method. Out of the 886 isolates tested, only one produced all 3 mycotoxins simultaneously whilst most produced fumonisin B1 and/or moniliformin. Only 9 isolates produced zearalenone.
PT: Journal-article
AN: 20013001858

TI: Interaction of Fusarium mycotoxins, fusaproliferin and fumonisin B1, with DNA studied by electrospray ionization mass spectrometry.
AU: Pocsfalvi-G; Ritieni-A; Randazzo-G; Dobo-A; Malorni-A
SO: Journal-of-Agricultural-and-Food-Chemistry. 2000, 48: 12, 5795-5801; 47 ref.
LA: English
AB: Electrospray ionization mass spectrometry (ESI-MS) in negative ion mode was used to monitor the possible noncovalent adduct formations between DNA analogue oligonucleotides and fumonisin B1 and fusaproliferin. Using mild experimental ESI conditions specific noncovalent interactions were detected between both single- and double-stranded model

oligonucleotides and fusaproliferin with 1:1 stoichiometry. Similar association complexes were observed for the deacetyl derivative of fusaproliferin. There were no peaks due to adduct formation present in the mass spectra of fumonisin B1, incubated with oligonucleotides in a wide concentration range, suggesting no specific interaction for this molecule. In a competitive complexation reaction, another mycotoxin, beauvericin, formed more stable association complex with DNA than fusaproliferin. It is concluded that these findings can be of use in the understanding of molecular mechanisms of action during apoptosis and can be correlated with the teratogenic effect of fusaproliferin.
PT: Journal-article
AN: 20013004593

TI: Mycotoxins from groundnuts marketed in Yemen.
AU: Al-Nahdi-S
SO: International-Arachis-Newsletter. 2000, No. 20, 59-62; 4 ref.
LA: English
AB: Imported and local groundnut samples were collected during January-February 1998 from wholesale markets, storage and retail shops in Aden, Hodida and Sana'a. The groundnuts were examined visually for external damage and were tested for contamination with toxinogenic fungi and mycotoxins. The majority of the samples (58%) showed visible damage. All samples were contaminated with fungi; contamination levels ranged from 9 to 60%. Samples from China showed a high level of contamination (17-60%), followed by samples from Sudan (9-45%), Yemen (14-34%) and India (9-33%). The dominant fungal species was Aspergillus flavus, which contaminated 37.4% of the samples, followed by Fusarium spp. (18.9%). Mycotoxins were detected in 52% of samples, with levels ranging from < 10 to 160 µg/kg. Mycotoxins were detected in 25%, 58% and 67% of samples from Sana'a, Aden and Hodida, respectively.
PT: Journal-article
AN: 20013005707

TI: Mycotoxins in Europe: current situation and future improvements.
AU: Vandemeulebroucke-C
SO: Cerevisia. 2000, 25: 4, 19-26; 43 ref.
LA: English
AB: The current situation of mycotoxins in Europe is discussed with particular reference to their occurrence in the barley-malt-beer chain. Aflatoxins, ochratoxin A, vomitoxin, other Fusarium toxins, Alternaria toxins and methods of analysis are considered.
PT: Journal-article
AN: 20013005953

TI: Consumer preferences and fungal and mycotoxin contamination of dried cassava products from Ghana.
AU: Wareing-PW; Westby-A; Gibbs-JA; Allotey-LT; Halm-M
SO: International-Journal-of-Food-Science-and-Technology. 2001, 36: 1, 1-10; 16 ref.
LA: English
AB: Members of 125 households from 19 villages producing dried cassava products were interviewed in Ghana [date not given]. Kokonte was the most important cassava product in 19% of the households processing it. Most kokonte was produced between January and March. Mould growth during processing or storage was a problem during June and July, which is part of the rainy season. Most producers and market traders preferred non-mouldy kokonte, although many (59%) would consume a mouldy product. There was a price premium

for non-mouldy kokonte. The most commonly isolated fungi were yeasts and Cladosporium spp. (44 out of 49 samples). Other fungi isolated included Aspergillus spp. (20 samples); Penicillium spp. (15 samples) and Fusarium spp. (30 samples). Sterigmatocystin was detected in 10 samples at 0.17-1.67 mg kg-1; patulin in 4 samples at 0.55-0.85 mg kg-1; cyclopiazonic acid in 4 samples at 0.08-0.72 mg kg-1; penicillic acid in 5 samples at 0.06-0.23 mg kg-1 and tenuazonic acid in 3 samples at 0.02-0.34 mg kg-1. Mycotoxin contamination of mouldy kokonte was a potential problem; there is therefore the need to improve kokonte processing to avoid mould growth.
PT: Journal-article
AN: 20013009181

TI: Toxicity of moniliformin and fumonisin B1 fed singly and in combination in diets for young channel catfish Ictalurus punctatus.
AU: Yildirim-M; Manning-BB; Lovell-RT; Grizzle-JM; Rottinghaus-GE
SO: Journal-of-the-World-Aquaculture-Society. 2000, 31: 4, 599-608; 27 ref.
LA: English
AB: Growth, histological lesions, and biochemical changes were investigated in channel catfish, I. punctatus fed various concentrations of moniliformin with or without fumonisin B1. Channel catfish (average initial weight, 1.5 g) were fed diets formulated to contain 0, 20, 40, 60, and 120 mg moniliformin/kg; 0, 20 and 40 mg fumonisin B1/kg, or two combinations of moniliformin and fumonisin B1 for 10 wk. Fish fed diets with the lowest concentration of moniliformin or fumonisin B1 (20 mg/kg diet) had lower ($P < 0.05$) weight gain than the control fish. Increasing the level of moniliformin in the diets resulted in a linear decrease in weight gain. Overall mortality of fish was 4% and not related to treatment effects. Hematocrit was lowered ($P < 0.05$) by 60-mg moniliformin/kg diet or 40-mg fumonisin B1/kg diet. Dose-dependent increases in serum pyruvate concentration and ratio of free sphinganine to free sphingosine were obtained with increasing concentration of dietary moniliformin and fumonisin B1, respectively. Mean serum pyruvate level was higher ($P < 0.05$) in fish fed the diet containing 60-mg moniliformin/kg diet. Addition of fumonisin B1 (40 mg/kg) to the diet containing 40-mg moniliformin/kg significantly increased the serum pyruvate level above that of the control. The lowest concentration of fumonisin B1 (20 mg/kg diet) increased ($P < 0.05$) the ratio of sphingolipids. Combinations of moniliformin and fumonisin B1 at levels of 20:40 and 40:40 mg/kg diet did not significantly change the effect of fumonisin B1 on the ratio of sphingolipids. The only tissue lesions observed in liver and heart were smaller nuclei of cells in livers of fish fed diets containing the two highest levels of moniliformin and the combinations of the two toxins.
PT: Journal-article
AN: 20013013371

TI: Ultrastructural and immunocytochemical investigation of pathogen development and host responses in resistant and susceptible wheat spikes infected by Fusarium culmorum.
AU: Kang-Z; Buchenauer-H
SO: Physiological-and-Molecular-Plant-Pathology. 2000, 57: 6, 255-268; 36 ref.
LA: English
AB: In order to elucidate resistance mechanisms of wheat cultivars to Fusarium head blight, the development of F. culmorum in the spikes as well as the toxin distribution in host cells and lignin contents in host cell walls were studied in spikes of resistant (Arina and Frontana) and susceptible (Agent) cultivars, by means of electron microscopy as well as immunogold labelling techniques. The results are discussed.
PT: Journal-article

AN: 20013017052

TI: Mycotoxins in barley and oat samples from eastern Canada.
AU: Campbell-H; Choo-TM; Vigier-B; Underhill-L
SO: Canadian-Journal-of-Plant-Science. 2000, 80: 4, 977-980; 20 ref.
LA: English
LS: French
AB: In Eastern Canada Fusarium species infect barley (Hordeum vulgare) and oats (Avena sativa) more frequently than wheat (Triticum aestivum), yet information on mycotoxin contamination in barley and oats is lacking. Such information is essential to determine the need for control of fusarium head blight in barley and oats. Therefore, data were retrieved from the Mycotoxin Databank of the Canadian Food Inspection Agency to study mycotoxin contamination in barley and oats from Eastern Canada. Of the 116 barley samples collected from 1991 to 1998 crops, 84 (72%) were contaminated with deoxynivalenol (DON). Some samples contained up to 8-9 mg kg-1 of DON. DON contamination was particularly severe in recent years (1996, 1997, and 1998). DON contamination was less frequent and less severe in oats in comparison with barley. Only 34 of the 73 oat samples (47%) contained DON. 34% of the barley samples (18/53) and 15% of the oat samples (4/26) contained nivalenol. Zearalenone, ochratoxin A, 3-acetyl DON, 15-acetyl DON, and T-2 were also detected at a low frequency; but HT-2, diacetoxyscirpenol (DAS), fusarenon X, 15-acetoxyscirpenol, and neosolaniol were not detected in these samples. The results suggest that breeding barley for resistance to DON accumulation is warranted in Eastern Canada.
PT: Journal-article
AN: 20013018122

TI: The effect of the Fusarium metabolite beauvericin on electromechanical and -physiological properties in isolated smooth and heart muscle preparations of guinea pigs.
AU: Lemmens-Gruber-R; Rachoy-B; Steininger-E; Kouri-K; Saleh-P; Krska-R; Josephs-R; Lemmens-M
SO: Mycopathologia. 2000, 149: 1, 5-12; 21 ref.
LA: English
AB: The electromechanical and electro-physiological effects of beauvericin were studied in isolated smooth and heart muscle preparations of the guineapig. Beauvericin concentration-dependently decreased the force of contraction in precontracted (60 mM KCl) terminal ilea with an IC50 of 0.86 µM, and in electrically stimulated (1 Hz) papillary muscles with an IC50 of 18 µM. This negative inotropic effect in papillary muscles was antagonised in a non-competitive way by increased extracellular calcium concentrations. Spontaneous activity in right atria was affected at concentrations > 10 µM beauvericin. The negative chronotropic effect was less pronounced than the negative inotropic effect. In action potentials of electrically driven (1 Hz) papillary muscles, 10 µM beauvericin significantly decreased membrane resting potential until unexcitability of the preparation occurred. Despite depolarization of the membrane the maximum rate of rise of the action potential was not changed. The action potential duration was shortened, but the decrease was only significant at times to 20% and 50% repolarization. These data, derived from the electrophysiological experiments, not only imply an effect on the calcium current as suggested by the effects on contractility, but also an interaction with the sodium inward and potassium outward currents.
PT: Journal-article
AN: 20013020151

TI: Mycoflora and mycotoxins in Brazilian black pepper, white pepper and Brazil nuts.

AU: Freire-Fd-CO; Kozakiewicz-Z; Paterson-RRM
SO: Mycopathologia. 2000, 149: 1, 13-19; 35 ref.
LA: English
AB: A wide range of field and storage fungi were isolated from black pepper, white pepper and Brazil nut kernels from Amazonia, Brazil. A total of 42 species were isolated from both peppers. Aspergillus flavus and A. niger were isolated more frequently from black than from white pepper. Other potential toxinogenic species isolated were A. ochraceus, A. tamarii, A. versicolor, Emericella nidulans, Chaetomium globosum, Penicillium brevicompactum, P. citrinum, P. islandicum and P. glabrum. Species isolated from pepper for the first time were Acrogenospora sphaerocephala, Cylindrocarpon lichenicola, Lacellinopsis sacchari, Microascus cinereus, Petriella setifera and Sporormiella minima. 17 species were isolated from Brazil nut kernels; A. flavus was the dominant species followed by A. niger. P. citrinum and P. glabrum were the only penicillia isolated. Species isolated for the first time included Acremonium curvulum, Cunninghamella elegans, Exophiala sp., Fusarium oxysporum, Pseudoallescheria boydii, Rhizopus oryzae, Scopulariopsis sp., Thielavia terricola and Trichoderma citrinoviride. Considerably more metabolites were detected from black than white pepper in qualitative analyses. Chaetocin, penitrem A and xanthocillin were identified only from black pepper, and tenuazonic acid was identified from both black and white pepper. Aflatoxin G2, chaetoglobosin C and spinulosin were identified from poor quality Brazil nuts. Aflatoxin B1 and B2 were also only detected in poor quality Brazil nuts at concentrations of 27.1 µg/kg and 2.1 µg/kg respectively (total 29.2 µg/kg).
PT: Journal-article
AN: 20013020152

TI: Occurrence of scab disease and Fusarium mycotoxins in cereals of Korea.
AU: Lee-YinWon; Lee-YW
SO: Bulletin-of-the-Institute-for-Comprehensive-Agricultural-Sciences,-Kinki-University. 2000, No. 8, 11-20; 40 ref.
LA: English
AB: Mycotoxin production by F. graminearum [Gibberella zeae] and F. oxysporum was observed in cereal isolates in the Korea Republic.
PT: Journal-article
AN: 20001007870

TI: The presence of mycotoxins and fungi in rice and corn in the southern United States.
AU: Abbas-HK; Cartwright-RD; Windham-GL; Xie-W; Shier-WT; Mirocha-CJ
SO: Bulletin-of-the-Institute-for-Comprehensive-Agricultural-Sciences,-Kinki-University. 2000, No. 8, 21-34; 84 ref.
LA: English
AB: Vomitoxin, zearalenone, fumonisins and aflatoxins were detected in rice and maize infected by Fusarium proliferatum, Ustilaginoidea virens and F. graminearum [Gibberella zeae].
PT: Journal-article
AN: 20001007871

TI: Gibberella fujikuroi mating population A and Fusarium subglutinans from teosinte species and maize from Mexico and Central America.
AU: Desjardins-AE; Plattner-RD; Gordon-TR
SO: Mycological-Research. 2000, 104: 7, 865-872; 43 ref.
LA: English

AB: Seed samples of maize (Zea mays ssp. mays) from Mexico and of teosintes (Zea spp.), the nearest wild relatives of maize, from Mexico, Guatemala, and Nicaragua were assessed for infection with Fusarium species. Strains similar in morphology to Fusarium moniliforme [Gibberella moniliformis] and F. subglutinans [Gibberella fujikuroi var. subglutinans] were the most frequent isolates from maize and from teosinte species including Z. diploperennis, Z. luxurians, Z. mays ssp. mexicana, and Z. mays ssp. parviglumis. Analysis of fertility, vegetative compatibility and mycotoxin production identified 63% of the 70 Gibberella moniliformis strains from teosinte as genetically diverse members of Gibberella fujikuroi mating population A, a common pathogen of maize. The Gibberella fujikuroi var. subglutinans strains from maize and teosinte were similarly genetically diverse, but were not fertile with standard testers of G. fujikuroi mating populations B and E, common pathogens of Poaceae, or of mating population H, which causes pitch canker disease of pine. Fifty-four percent of the 80 Gibberella fujikuroi var. subglutinans strains were fertile when crossed with female tester strains from teosinte and maize collected in a field at Netzahualcoyotyl in the state of Mexico. These strains from Mexico and Central America may comprise a new and distinct G. fujikuroi mating population, but a strain from the Netzahualcoyotyl field site was fertile with a strain of G. fujikuroi mating population H from California. Thus, Gibberella fujikuroi var. subglutinans from teosinte and maize may have a close relationship to mating population H from pine.
PT: Journal-article
AN: 20001008529

TI: The occurrence of cereal crop diseases depending on the system of farming.
AU: Lisowicz-F
SO: Journal-of-Plant-Protection-Research. 1999, 39: 2, 116-131; 12 ref.
LA: English
LS: Polish
AB: The paper presents results of studies conducted in 1995-1997 on the occurrence of diseases of winter wheat and spring barley depending on the system of farming (extensive, ecological, integrated) and on the influence of disease infection upon seed quality and content of Fusarium toxins.
PT: Journal-article
AN: 20001008614

TI: Moniliformin accumulation in kernels of triticale accessions inoculated with Fusarium avenaceum, in Poland.
AU: Chelkowski-J; Kaptur-P; Tomkowiak-M; Kostecki-M; Golinski-P; Ponitka-A; Slusarkiewicz-Jarzina-A; Bocianowski-J
SO: Journal-of-Phytopathology. 2000, 148: 7-8, 433-439; 22 ref.
LA: English
LS: German
AB: Twelve Polish winter triticale cultivars and 14 double haploid lines (DH) (derived from the cv. LaskoXline SZD 366 hybrids) were inoculated with Fusarium avenaceum [Gibberella avenacea] isolate ATCC 64451, mycotoxin moniliformin (MON) producer to evaluate their susceptibility to Fusarium head blight (FHB). Chemical analysis revealed MON accumulation in kernels of all inoculated cultivars in three consecutive years with the following averages and ranges: 1.50 mg/kg (0.47-2.67 mg/kg) in 1996, 2.63 mg/kg (0.11-8.14 mg/kg) in 1997 and 0.25 mg/kg (0.07-0.47 mg/kg) in 1998. Cultivar Malno kernels accumulated a low levels of MON in all 3 years of the experiment. In most of the genotypes examined the reaction to the pathogen and MON content changed significantly from season to season. DH lines

accumulated on average 2.62 and 0.85 mg/kg of MON in 1997 and 1998, respectively. Yield parameter reductions (1000 kernel weight, kernel number per head and kernel weight per head) were higher in 1997 than in 1998. The correlation coefficient for MON content/Fusarium damaged kernels percentage was 0.539 in cultivars and 0.548 in the DH lines. This is the first report of FHB of a segregating population in triticale.
PT: Journal-article
AN: 20001008904

TI: Mycotoxin production by Fusarium proliferatum isolates from rice with Fusarium sheath rot disease.
AU: Abbas-HK; Cartwright-RD; Xie-W; Mirocha-CJ; Richard-JL; Dvorak-TJ; Sciumbato-GL; Shier-WT
SO: Mycopathologia. 1999, 147: 2, 97-104; 41 ref.
LA: English
AB: Twenty samples of unpolished (rough) rice collected in Arkansas and Texas during the 1995 harvesting season from fields exhibiting Fusarium sheath rot disease or panicle blight were previously shown to include 8 samples positive for fumonisin B1 (FB1) in the range 2.2-5.2 ppm, and moniliformin (MON), but no beauvericin (BEA), deoxynivalenol, its derivatives or zearalenone were detected. Fifteen cultures of F. proliferatum were established from the 20 rough rice samples. Single spore isolates of each culture were grown on rice and tested for the production of fumonisins (FB1, FB2, FB3, etc.), MON and BEA. All 15 isolates produced FB1, FB2, MON and BEA in culture on rice. No deoxynivalenol, its derivatives or zearalenone were detected. Seven cultures produced FB1 at >50 ppm (range 80-230 ppm), with the rest producing FB1 in the range 14-43 ppm. FB2 was produced in the range 5-47 ppm, and those cultures which produced the most FB1 also produced the most FB2. Of the 15 cultures producing MON, 11 produced it at >100 ppm in the range 188-6018 ppm, with the rest producing in the range 7-64 ppm. BEA was produced in the range 109-1350 ppm. Other derivatives of fumonisins, including FA1, FA2 and partially hydrolysed FB1, as well as several unknown metabolites including a compound with MW 414, were identified in culture extracts by continuous flow fast atom bombardment with ion spray mass spectrometry (CF/FAB/MS). Further study is needed to identify the factors that control production of FB1, MON and BEA by F. proliferatum in culture and in field samples.
PT: Journal-article
AN: 20001009279

TI: Factors affecting Fusarium infection and mycotoxin content in cereal grains.
AU: Henriksen-B
SO: 1999, 98 pp.; many ref.
PB: Norges Landbrukshogskole (Agricultural University of Norway), As; Norway
LA: English
LS: Norwegian
AB: Fusarium infection levels, mycotoxin content and prevalence of different Fusarium species were studied in cereal grains from field experiments at 5 Norwegian localities from 1994-1997. The effect of tillage treatments,fungicide application, location and climatic parameters were investigated in this thesis.
PT: Thesis
IB: 82-575-0379-7
AN: 20001009378

TI: Effect of tillage and preceding crops on Fusarium infection and deoxynivalenol content of wheat.
AU: Krebs-H; Streit-B; Forrer-HR; Alfoldi-T (ed.); Lockeretz-W (ed.); Niggli-U
SO: IFOAM 2000: the world grows organic. Proceedings 13th International IFOAM Scientific Conference, Basel, Switzerland, 28 to 31 August, 2000. 2000, 113; 2 ref.
PB: vdf Hochschulverlag AG an der ETH Zurich; Zurich; Switzerland
LA: English
AB: In two field trials in the Swiss midlands, the influence of tillage (with mouldboard plough or chisel plough, or no-tillage) and the preceding crop (winter wheat, rape or maize) was investigated on Fusarium graminearum [Gibberella zeae] of wheat. Compared to no-tillage, mouldboard plough and chisel plough tillage reduced the incidence of F. graminearum and its mycotoxin deoxynivalenol [vomitoxin]. In no-tillage plots with rape as the preceding crop, F. graminearum infection and deoxynivalenol content were >90% lower than with maize as the preceding crop.
PT: Conference-paper
IB: 3-7281-2754-X
AN: 20001009818

TI: Effects of the Fusarium spp. mycotoxins fusaric acid and deoxynivalenol on the growth of Ruminococcus albus and Methanobrevibacter ruminantium.
AU: May-HD; Wu-QingZhong; Blake-CK; Wu-QZ
SO: Canadian-Journal-of-Microbiology. 2000, 46: 8, 692-699; 50 ref.
LA: English
LS: French
AB: Fusaric acid and deoxynivalenol [vomitoxin] (DON) were tested for antimicrobial activity against R. albus and M. ruminantium. The growth of both organisms was inhibited by fusaric acid as low as 15 µg/ml (84 µM) but not by DON, at levels as high as 100 µg/ml (338 µM). No synergistic inhibitory effect was observed with DON plus fusaric acid. Neither organism was able to adapt to the fusaric acid and responses of each organism to the compound were different. The optical density (OD) maximum for R. albus, but not for M. ruminantium, was diminished after 28 days incubation at concentrations of fusaric acid <240 µg/ml. Inhibition of R. albus started before significant growth had occurred, while M. ruminantium doubled twice before the onset of inhibition. Responses to picolinic acid, an analogue of fusaric acid, were also dramatically different between the 2 microorganisms, with M. ruminantium exhibiting a severe lag followed by a complete recovery of growth, while R. albus was only slightly inhibited with no lag. These results suggest that the mechanism of fusaric acid inhibition is specific to each microorganism.
PT: Journal-article
AN: 20001203544

TI: Pre-harvest accumulation of deoxynivalenol in sweet corn ears inoculated with Fusarium graminearum.
AU: Reid-LM; Zhu-X; Savard-ME; Sinha-RC; Vigier-B
SO: Food-Additives-and-Contaminants. 2000, 17: 8, 689-701; 46 ref.
LA: English
AB: Three types of commercial sweet corn hybrids [sugary (su 1), shrunken or 'supersweet' (sh2) and sugary enhancer (se1)] were silk channel inoculated in 1996 and 1997 with a macroconidial suspension of Fusarium graminearum to determine how early the mycotoxin deoxynivalenol accumulates in kernels. Disease symptoms rapidly developed on all hybrids

and were apparent 4 days after inoculation. Symptoms stabilized by 28 days after inoculation. Toxin levels were greater than 1 µg/g in kernels as early as 2 weeks after silk emergence and rapidly increased to extremely high levels. Susceptibility in all hybrids decreased as the silk dried out. Deoxynivalenol concentrations were correlated to disease severity. There was some indication that the sh2 genotype was more susceptible than the su1 or se1 genotypes. These results suggest that improvement needs to be made in sweet corn with respect to resistance to gibberella ear rot.
PT: Journal-article
AN: 20001203868

TI: Evaluation of mycotoxin-contaminated cereals for their use in animal feeds in Hungary.
AU: Rafai-P; Bata-A; Jakab-L; Vanyi-A
SO: Food-Additives-and-Contaminants. 2000, 17: 9, 799-808; 52 ref.
LA: English
AB: In the period between 5 December 1991 and 17 September 1998, 760 maize, 367 wheat, 119 soyabean, 222 barley, 85 bran, 32 triticale, 60 oat, 14 rye and 22 sunflower samples were investigated for the presence and concentration of seven fusariotoxins (T-2 toxin, zearalenone, deoxynivalenol, nivalenol, diacetoxyscirpenol, HT-2 toxin, fusarenone-X) and OTA. The comparison of analytical data with those of the relevant literature revealed that although the incidence rate and/or concentration of Fusarium mycotoxins and OTA in Hungarian-grown cereals is occasionally considerable, the position of the country is not worse than the average of countries. Our findings indicate that soyabean tends to be good substrate for trichothecene-producing fungi and the rate of contamination is regarded as substantial. The commodities were assorted into one of 3 quality categories. The proportion of objectionable samples was only 3.0, 2.2, 2.3 and 1.7% in maize, wheat, barley and soyabean samples, respectively. However, this low rate of objection might still be a source of great economic loss. The proportion of objectionable samples was much higher in the case of bran, oat and triticale (7.1, 6.7, and 6.3%, respectively). The results of the present investigation indicate a need for regular screening for mycotoxins of importance and individual appraisal of each commodity from the point of their use in animal feeds.
PT: Journal-article
AN: 20001203870

TI: Biodeterioration of stored seeds of certain arid zone tree species.
AU: Bohra-NK; Purohit-DK
SO: Indian-Phytopathology. 2000, 53: 1, 112-114; 19 ref.
LA: English
AB: The mycoflora of stored seeds of Prosopis cineraria (Khejri) and Acacia senegal (Kumat) collected from different localities of Rajasthan, India, were studied using the blotter paper technique, and the aflatoxin producing potential of Aspergillus flavus isolates was determined. A. flavus was dominant in almost all samples tested in the blotter paper study. A. niger, A. fumigatus and A. ochraceus were also present in abundance, while species of Fusarium, Curvularia, Chaetomium, Alternaria, Stachybotrys and Rhizopus were also recorded in some of the samples. The results showed that out of 78 isolates of A. flavus from Acacia senegal, 38 isolates were toxic and produced aflatoxin in liquid medium. Aflatoxin B1 was produced by 30 isolates; 6 isolates produced aflatoxin B1 and B2 together; and 2 isolates produced aflatoxin B1, B2, G1 and G2. For Prosopis cineraria, 23 out of 54 isolates of A. flavus produced aflatoxins. B1 was produced by 21 isolates while B1 and B2 were formed by only 2 isolates. None of the isolates produced all four aflatoxins. A study of the biodeterioration of seeds of P. cineraria and A. senegal by A. flavus showed a reduction in

reducing sugar, total soluble sugar and protein content, and an increase in phenol concentration, of the seeds.
PT: Journal-article
AN: 20001006436

TI: Biosynthesis of deoxynivalenol in spikelets of barley inoculated with macroconidia of Fusarium graminearum.
AU: Evans-CK; Xie-W; Dill-Macky-R; Mirocha-CJ
SO: Plant-Disease. 2000, 84: 6, 654-660; 29 ref.
LA: English
AB: This research examined the biosynthesis of deoxynivalenol [vomitoxin] (DON) and 15-acetyldeoxynivalenol (15-ADON) in barley spikelets inoculated with macroconidia of Fusarium graminearum [Gibberella zeae] (Group-II). Investigations were conducted to determine if these toxins were present in macroconidia of the pathogen prior to inoculating barley spikelets. Extracts of macroconidia cultured from mung bean agar were analyzed using gas chromatography-mass spectrometry. Neither DON or 15-ADON were detected in the macroconidia of 3 isolates when compared with macroconidia-DON-matrix standards adjusted to 100, 200, 300, and 400 ng/g with a detection limit of 100 ng/g. Mean recovery of DON that was added to macroconidia was 89.5%. The same isolates were pathogenic on barley cultivars Robust (moderately susceptible) and Chevron (moderately resistant) and produced DON (0 to 3.69 ng/g) and 15-ADON (detected, but not quantified) when grown in rice culture. Greenhouse experiments were performed to determine when DON and 15-ADON were detectable after inoculation and to quantify their amount in inoculated barley spikelets. The three isolates of F. graminearum were separately inoculated to a central spikelet on heads of Robust and Chevron. Both toxins were detected in spikelets 48 h post-inoculation (PI). DON increased dramatically after 72 h and did not diminish thereafter. Accumulation of 15-ADON peaked at 72 to 120 h and decreased by 240 h PI. There were no statistical differences between cultivars or among fungal isolates for accumulation of either toxin when averaged over the time intervals. Differences of toxin accumulation at each sampling interval were significant ($P<0.0001$) when averaged over isolates and cultivars. Spikelets of six cultivars and lines were sampled at inoculation and 18, 36, 54, 72, and 90 h PI. DON and 15-ADON were detected at 36 h PI, but differences among the cultivars and lines were not significant. Yields of DON in inoculated spikelets of 31 barley cultivars and lines at 72 h PI ranged from 0.14 to 1.26 µg per spikelet, and differences among the cultivars and lines were significant ($P<0.002$). The data demonstrate a useful range of variability for toxin accumulation in inoculated spikelets among germ plasm in the Minnesota breeding programme.
PT: Journal-article
AN: 20001006506

TI: Fungi associated with wheat grains with special reference to mycotoxin producing isolates.
AU: Atalla-MM; Hassanein-NM; El-Beih-AA; Youssef-YA
SO: Proceedings of The Second International Conference on Fungi: Hopes and Challenges, 29 September to 1 October 1999, Cairo, Egypt. African-Journal-of-Mycology-and-Biotechnology. 1999, 7: 3, 35-48; 31 ref.
LA: English
AB: A survey was carried out during 1996-98 on the microflora associated with diseased wheat grains collected from different governorates in Egypt and from that imported from outside the country. Ninety-five fungal isolates belonging to 15 genera were obtained from

local wheat grains: Absidia, Alternaria, Aspergillus, Aureobasidium, Byssochlamys, Emerici ella, Fusarium, Geotrichum, Mucor, Neosartorya, Penicillium, Rhizopus, Scopulariopsis, Trichoderma and Verticillium. Aspergillus isolates were most widely distributed, being found in the majority of governorates at high frequency relative to the other fungi. Aspergillus represented 54.17% of the total isolates obtained, with A. oryzae being dominant. Twenty-five fungal isolates belonging to 13 genera were obtained from imported wheat grains: Acremonium, Alternaria, Aspergillus, Aureobasidium, Cladosporium, Epicoccum, Geotrichum, Hansfordia, Penicillium, Rhizopus, Scopulariopsis, Syncephalastrum and Verticillium. Penicillium isolates were dominant. All isolates were tested for their ability to produce antibiotics in culture media. Isolates varied for their capability to produce toxins. Of the 52 Aspergillus isolates from local wheat grains, A. oryzae, A. parasiticus and A. terreus were high producers of toxins against Gram positive and Gram negative bacteria, yeasts, and fungi. Scopulariopsis fusca and Verticillium lecanii were also high toxin producers. Investigations of toxins present in diseased wheat grains showed the presence of the following toxins: aflatoxins B1, B2, G1 and G2, ochratoxins A and B, zearalenone, sterigmatocystin, nivalenol, deoxynivalenol [vomitoxin], and T-2 toxin. The fungal isolates varied in the toxins they produce.
PT: Conference-paper; Journal-article
AN: 20001006638

TI: Interaction of Fusarium graminearum and F. moniliforme in maize ears: disease progress, fungal biomass, and mycotoxin accumulation.
AU: Reid-LM; Nicol-RW; Ouellet-T; Savard-M; Miller-JD; Young-JC; Stewart-DW; Schaafsma-AW
SO: Phytopathology. 1999, 89: 11, 1028-1037; 66 ref.
LA: English
AB: To investigate the interaction between two major ear-rotting pathogens, maize ears were inoculated with either Fusarium graminearum [Gibberella zeae], F. moniliforme [G. fujikuroi], or an equal mixture of the two in Ontario, Canada. Silk and kernel tissues were periodically harvested throughout the growing season so that a time course of the experimental variables (disease severity, ergosterol content, fungal DNA content, and mycotoxin concentration) could be recorded. Over the 3 years tested (1992 to 1994), the highest levels of disease and ergosterol were found in the F. graminearum treatment, followed F. graminearum + F. moniliforme treatment and, finally, the F. moniliforme treatment. Kernel ergosterol content and disease rating were correlated for both pathogens, but the highest correlation coefficients were obtained in the F. graminearum treatment. The DNA analysis revealed that, in the mixed inoculum, F. moniliforme had a greater growth rate than did F. graminearum. In 1994, appreciable F. moniliforme from natural inoculum was found in the F. graminearum treatment. Fumonisin B1 levels did not differ between the F. moniliforme treatment and the mixed inoculum treatment. The effect of temperature on the growth rate of the two species explained some of the field results, with temperatures in the silks being more favourable to F. moniliforme. Data on the growth rate of silks obtained by the incorporation of radiolabelled precursor to ergosterol demonstrated that F. graminearum was able to grow well at 26 to 28°C, whereas F. moniliforme grew well over a broader range, including at higher temperatures.
PT: Journal-article
AN: 20001006775

TI: Two-dimensional profiles of fumonisin B1 production by Fusarium moniliforme and Fusarium proliferatum in relation to environmental factors and potential for modelling toxin formation in maize grain.
AU: Marin-S; Magan-N; Belli-N; Ramos-AJ; Canela-R; Sanchis-V
SO: International-Journal-of-Food-Microbiology. 1999, 51: 2-3, 159-167; 33 ref.
LA: English
AB: This study has examined in detail the effect of temperature (7-37°C) and water availability (water activity, aw, 0.89-0.97) on fumonisin B1 (FB1) production by an isolate of Fusarium moniliforme [Gibberella fujikuroi] and F. proliferatum on irradiated maize grain after incubation for 28 days. The optimum conditions for F. moniliforme and F. proliferatum were 30°C at 0.97 aw and 15°C at 0.97 aw, respectively. The maximum concentrations were 2861 mg kg-1 and 17 628 mg kg-1 dry wt. maize grain, respectively. At marginal aw/temperature conditions for growth (e.g. 0.89-0.91 aw) no FB1 was detected (<0.1 mg kg-1). A high variability was found between replicates for F. moniliforme, but not for F. proliferatum. These data were used to construct two-dimensional diagrams of all the awXtemperature conditions favourable for FB1 production for the first time. The data were also subjected to a polynomial regression, which demonstrated that there was a very good fit for the 15-30°C range of temperature and at 0.97 aw. However, at marginal environmental conditions this was not possible. This suggests that it may be possible to predict within a limited environmental range the potential for significant FB1 production.
PT: Journal-article
AN: 20001007458

TI: A survey of Fusarium toxins in cereal-based foods marketed in an area of southwest Germany.
AU: Schollenberger-M; Suchy-S; Jara-HT; Drochner-W; Muller-HM
SO: Mycopathologia. 1999, 147: 1, 49-57; 31 ref.
LA: English
AB: A total of 237 commercially available samples of cereal-based foods including bread and related products, noodles, breakfast cereals, baby and infant foods, rice and other foods were randomly collected in southwest Germany during the first six months of 1998. The trichothecenes deoxynivalenol [vomitoxin] (DON), 3-and 15-acetyl-deoxynivalenol (3-,15-ADON), nivalenol (NIV), fusarenon-X (FUS-X), T-2 toxin (T-2) and HT-2 toxin (HT-2) were determined by gas chromatography/mass spectrometry following clean-up by a two stage solid-phase extraction. Detection limits ranged between 2 and 12 µg/kg. Based on all samples, the incidence of DON, HT-2, T-2, 3-ADON, 15-ADON and NIV was at 71, 18, 4, 4, 4 and 2%, respectively; the mean contents in positive samples were at 103, 16, 14, 17, 24 and 109 µg/kg, respectively. Fus-X was not detected in any sample. A lower (P<0.05) DON content was found in baby and infant foods as well as in cookies and cakes compared with bread. Overall, based on the incidence and level of all 6 toxins, the degree of contamination was lowest in baby and infant foods. Foods produced from either white or whole grain flour did not differ (P>0.05) with regard to the incidence and level of DON. In foods produced from cereals of organic production both the incidence and median content of DON was lower compared with conventional production. Zearalenone, alpha- and beta-zearalenol were determined by high performance liquid chromatography in 20 selected samples, mostly baby and infant foods. These toxins were not present in excess of the detection limit in any sample.
PT: Journal-article
AN: 20001202851

TI: Inhibitory effect of Fusarium mycotoxins on growth of brewing yeasts. 2. Deoxynivalenol and nivalenol.
AU: Boeira-LS; Bryce-JH; Stewart-GG; Flannigan-B
SO: Journal-of-the-Institute-of-Brewing. 1999, 105: 6, 376-381; 28 ref.
LA: English
AB: The effect of the trichothecene mycotoxins deoxynivalenol [vomitoxin] (DON) and nivalenol (NIV) on growth of Saccharomyces cerevisiae lager and ale strains was studied. The toxins were added into the growth medium in low and high concentrations. Yeast growth was assessed by measurement of dry weight or relative growth, cell number, viability and conductance change of the growth medium using direct and indirect methods. The inhibitory effect of both DON and NIV on yeast growth was dependent on toxin concentration. Additionally, when the extent of inhibition of yeast growth caused by high concentrations of both toxins was observed, it was subject to yeast strain, length of incubation and method used to assess yeast growth. The lowest concentrations of mycotoxin causing significant inhibition on growth of brewing yeasts were 100 µg/ml DON for the lager strain and 50 µg/ml for the ale strain, and 50 µg/ml NIV for the ale strain.
PT: Journal-article
AN: 20001203062

TI: Common toxigenic Fusarium species in maize grain in Ethiopia.
AU: Wubet-T; Abate-D
SO: Sinet,-an-Ethiopian-Journal-of-Science. 2000, 23: 1, 73-86; 30 ref.
LA: English
AB: Prevalence of toxigenic species of Fusarium in maize samples collected in Ethiopia in 1995 from farmers' stores and markets was investigated. The 3 toxigenic species of Fusarium most often associated with maize grain were F. verticillioides (51.7%), F. subglutinans [Gibberella fujikuroi var. subglutinans] (24.2%) and F. graminearum [Gibberella zeae] (13.9%). Other Fusarium species contributed 10.2% of the total species recovered. A large number of strains of F. verticillioides, G. fujikuroi var. subglutinans and G. zeae are known to produce toxic secondary metabolites. The incidence of Fusarium species and the mycotoxins they produce have been positively correlated with numerous toxicoses of man and animals. Thus, the prevalence rate of these toxigenic Fusarium spp. in Ethiopian maize, destined for human consumption, suggests the possible contamination of maize and its products by Fusarium mycotoxins.
PT: Journal-article
AN: 20001203064

TI: Fumonisin B1 influenced the effects of arachidonic acid, prostaglandins E2 and A2 on cell cycle progression, apoptosis induction, tyrosine- and CDC2-kinase activity in oesophageal cancer cells.
AU: Seegers-JC; Joubert-AM; Panzer-A; Lottering-ML; Jordan-CA; Joubert-F; Maree-JL; Bianchi-P; Kock-M-de; Gelderblom-WCA; de-Kock-M
SO: Prostaglandins-Leukotrienes-and-Essential-Fatty-Acids. 2000, 62: 2, 75-84; 32 ref.
LA: English
AB: A previous study showed a group of lipids including arachidonic acid (AA), prostaglandins E2 (PGE2) and A2 (PGA2), PGA2 had the most marked effect on the inhibition of cell growth, activation of tyrosine kinase activity, lowering of the number of G1-phase cells, and induction of p53 levels in oesophageal carcinoma (WHCO3) cells17. No significant effects by the 3 lipids were seen in normal monkey kidney cells. In this study, the effects of the inhibitor of ceramide synthesis, fumonisin B1 (FB1), a metabolite of Fusarium

verticillioides, which is implicated in the high incidence of oesophageal cancer, were determined on AA, PGE2 and PGA2 WHCO3 treated cells. In the presence of FB1, the lipid-enhanced tyrosine kinase activity was lowered. Flow cytometric and morphological studies showed that FB1 lowered the marked apoptosis induced by especially PGA2. FB1, however, in combination with AA, PGE2 or PGA2 increased the number of G2/M cells. AA > PGE2 > PGA2 alone decreased CDC2-kinase activity, but, in the presence of FB1, CDC2-kinase activity was significantly increased. The PGA2- and AA-induced p53 levels were lowered in the presence of FB1. It is concluded that FB1 diminished the cytotoxic effects of the lipids on oesophageal tumour cells.
PT: Journal-article
AN: 20001203302

TI: Anti-nutritional factors and mycotoxins.
AU: D'-Mello-JPF; D'-Mello-JPF
SO: Farm-animal-metabolism-and-nutrition. 2000, 383-403; 27 ref.
PB: CABI Publishing; Wallingford; UK
LA: English
AB: This review considers plant antinutritional factors (such as lectins, proteinase inhibitors, antigenic proteins, condensed tannins, quinolizidine alkaloids, glucosinolates, amino acids, phyto-oestrogens, and other plant secondary compounds) and mycotoxins (aflatoxins, ochratoxins, Fusarium mycotoxins, endophyte alkaloids, phomopsins, and sporidesmin), their metabolism and toxicology, preventive and remedial measures, and regulatory and advisory directives.
PT: Book-chapter
IB: 0-85199-378-8
AN: 20001415332

TI: A longevity assurance gene homolog of tomato mediates resistance to Alternaria alternata f. sp. lycopersici toxins and fumonisin B1.
AU: Brandwagt-BF; Mesbah-LA; Takken-FLW; Laurent-PL; Kneppers-TJA; Hille-J; Nijkamp-HJJ
SO: Proceedings-of-the-National-Academy-of-Sciences-of-the-United-States-of-America. 2000, 97: 9, 4961-4966; 35 ref.
LA: English
AB: The phytopathogenic fungus Alternaria alternata f.sp. lycopersici (AAL) produces toxins that are essential for pathogenicity of the fungus on tomato (Lycopersicon esculentum). AAL toxins and fumonisins of the unrelated fungus Fusarium moniliforme [Gibberella fujikuroi] are sphinganine-analog mycotoxins (SAMs), which cause inhibition of sphingolipid biosynthesis in vitro and are toxic for some plant species and mammalian cell lines. Sphingolipids can be determinants in the proliferation or death of cells. We investigated the tomato Alternaria stem canker (Asc) locus, which mediates resistance to SAM-induced apoptosis. Until now, mycotoxin resistance of plants has been associated with detoxification and altered affinity or absence of the toxin targets. Here we show that SAM resistance of tomato is determined by Asc-1, a gene homologous to the yeast longevity assurance gene LAG1 and that susceptibility is associated with a mutant Asc-1. Because both sphingolipid synthesis and LAG1 facilitate endocytosis of glycosylphosphatidylinositol-anchored proteins in yeast, we propose a role for Asc-1 in a salvage mechanism of sphingolipid-depleted plant cells. Nucleotide sequences reported here have been submitted to GenBank under accession numbers AF198177 (Le-Asc-1), AF198178 (Le-asc-1), AF198179 (LAG1 At-1) and AF198180 (LAG At-2).

PT: Journal-article
AN: 20001612646

TI: Experiment to determine limits of tolerance for fumonisin B1 in weaned piglets.
AU: Zomborszky-MK; Vetesi-F; Repa-I; Kovacs-F; Bata-A; Horn-P; Toth-A; Romvari-R
SO: Journal-of-Veterinary-Medicine.-Series-B. 2000, 47: 4, 277-286; 14 ref.
LA: English
AB: The effects of exposure to low doses of fumonisin B1 (FB1) for 4 weeks were examined in 20 weaned Danish Landrace piglets. Fusarium moniliforme [Gibberella fujikuroi] was mixed into diet resulting in daily intake of 0, 10, 20 or 40 mg/kg feed. No significant effect of FB1 on weight gain or feed intake was observed nor was there any clinical signs or mortality. Computed tomography revealed mild or more severe pulmonary oedema 2 and 4 weeks after administration of FB1. No haematological changes were observed. Aspartate aminotransferase activity increased in a dose-dependant fashion, indicating pathological changes in the liver. Free sphinganine to sphingosine ratio, which is the most sensitive bioindicator of fumonisin toxicosis, also increased in a dose-dependant fashion. PM examination revealed mild pulmonary oedema in 3 of 4 animals given FB1 at 10 mg/kg, 2 mild and 2 severe cases of pulmonary oedema in 5 animals exposed to 20 mg/kg, and severe oedema in all 5 animals given 40 mg/kg of FB1. Oedema of non-inflammatory origin was confirmed by histopathological examinations.
PT: Journal-article
AN: 20002214216